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THE EVENING POLYTECHNIC SCHOOL

CATALOG

1913-14

EVENING COLLEGE COURSES

PUBLISHED BY
DEPARTMENT OF EDUCATION

OF THE

BOSTON YOUNG MEN'S CHRISTIAN ASSOCIATION
312 HUNTINGTON AVENUE ./. BOSTON, MASS.

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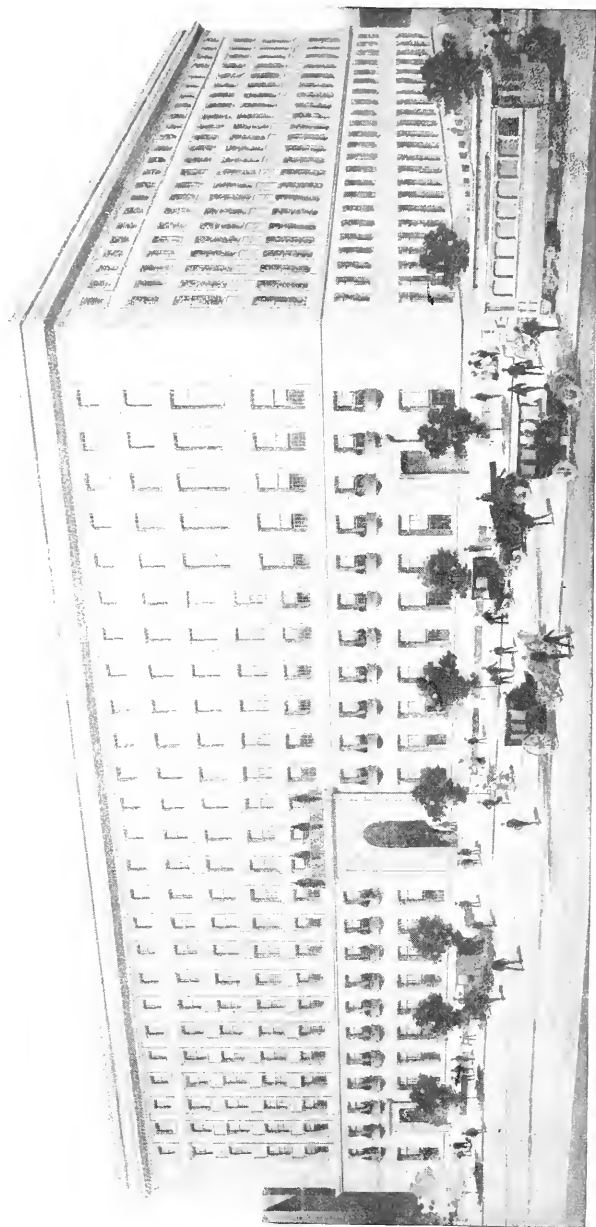
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The Evening Polytechnic School

Catalog
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Published by
Department of Education
Boston Young Men's Christian Association



NEW BUILDING

Calendar

1913-1914

Sept. 18, 19, 20.	Registration
Sept. 29.	Opening of term
Oct. 13.	Columbus Day, Holiday
Nov. 27.	Thanksgiving Day, Holiday
Dec. 20-27.	Christmas Recess
Feb. 23.	Washington's Birthday, Holiday
April 20.	Patriots' Day, Holiday
May 1.	Close of Winter Term

Officers of Administration



General Administrative Officers

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DEAN

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Physics

JAMES M. BARKER, S.B.
Structural Engineering

HENRY BARRETT, JR.
Illustrating and Cartooning

ROYALL D. BRADBURY, S.B.
Structural Engineering

JAMES BROUGH
Freehand Drawing and Industrial Design

LOREN DOWNS, S.B.
Electrical Engineering

A. L. GARDNER, S.B.
Mechanical Engineering

FRED G. HARTWELL
Electrical Practice and Construction

JOHN W. HOWARD, S.B.
Surveying

DANIEL KNOWLTON, S.B.
Plan Reading and Estimating

CHARLES H. B. MORSE
Illustrating and Cartooning

EDWARD MUELLER, A.B., PH.D.
Chemistry

W. W. NORTON
Surveying

THOMAS E. PENARD, S.B.
Mathematics

M. F. PINKHAM
Mathematics

CHARLES H. RESTALL, S.B.
Railroad Engineering

W. LINCOLN SMITH, S.B.
Electrical Engineering

W. NELSON SMITH, M.E.
Electric Railways

ELLWOOD B. SPEAR, A.B., PH.D.
Chemistry

SAMUEL A. S. STRAHAN
Chemistry

GEORGE A. TRUELSON
Architecture

Foreword

A great many men employed in engineering and other work of a technical nature, feel the need of special instruction but cannot afford to take the time to attend the regular technical day schools. To such men the Evening Polytechnic School offers a large number of special courses and to those who are willing to give three evenings per week for a period of from three to five years the school offers several regular courses of very high grade which compare favorably with similar courses given in the good technical schools of the country.

The courses offered in this school are with a very few exceptions of college grade, so that the graduates will find themselves trained to meet the problems arising in engineering practice. They are sufficiently well equipped to hold important positions, and acquit themselves creditably.

On the following pages will be found a complete description of the regular and special courses, requirements for admission, rates of tuition and other general information.

Courses of Study

Regular Courses

- I.—Chemistry and Chemical Engineering
- II.—Electrical Engineering
- III.—Structural Engineering
- IV.—Railroad Engineering
- V.—Municipal Engineering

Schedule of Courses

No.	Course	No.	Weeks	Evenings	Time
1	Mathematics I	30	Mon., Fri.		7.45- 8.30
2	Mathematics II	30	Mon., Fri.		7.00- 7.45
3	Trigonometry	20	Wed.		7.00- 7.45
4	Logarithms and Slide Rule	20	Wed.		7.45- 8.30
5	Mechanical Drawing I	30	Mon., Fri.		7.00-10.00
6	Mechanical Drawing II	30	Wed.		7.00-10.00
7	Lettering	30	Mon., Fri.		7.00- 7.45
8	Machine Drawing	30	Mon., Fri.		7.00-10.00
9	Architectural Drawing I	30	Mon., Fri.		7.00- 9.00
10	Architectural Drawing II	30	Mon., Fri.		7.00- 9.00
11	Freehand Drawing I	30	Tues., Sat.		7.30- 9.30
12	Freehand Drawing II	30	Tues., Sat.		7.30- 9.30
13	Industrial Design	30	Tues., Sat.		7.30- 9.30
14	Illustrating and Cartooning	30	Tues., Thurs., Sat.		7.30- 9.30
15	Plan Reading and Estimating				
16	Physics I	30	Mon., Fri.		8.30-10.00
17	Physics II	15	Mon., Fri.		8.30-10.00
18	Inorganic Chemistry Lect.	30	Mon., Fri.		7.00- 7.45
19	Inorganic Chemistry Lab.	30	Wed.		7.00-10.00
20	Qualitative Analysis	20	Mon., Tues.		A
21	Volumetric Analysis	10	Mon., Tues.		A
22	Gravimetric Analysis	15	Mon., Tues., Wed.		A
23	Organic Chemistry	30	Mon., Tues., Wed.		A
24	Technical Analysis	15	Mon., Tues., Wed.		A
25	Theoretical Chemistry I	30	Wed.		7.00- 7.45
26	Theoretical Chemistry II	30	Fri.		7.00- 7.45
27	Industrial Chemistry	30	Mon.		7.45- 8.30
28	Journals	30	Mon.		7.00- 7.45
29	Electricity Ia	15	Mon., Fri.		7.00- 7.45
30	Electricity Ib	15	Mon., Fri.		7.00- 7.45
31	Electricity IIa	15	Wed.		7.00-10.00
32	Electricity IIb	15	Wed.		7.00-10.00
33	Electricity III	30	Wed., Fri.		B
34	Electricity IV	30	Wed.		7.45-10.00
35	Direct Current Practice	30	Mon., Fri.		8.30-10.00
36	Switchboards & Apparatus	15	Mon.		7.45- 8.30
37	Wiring and Nat. Code	15	Mon.		7.45- 8.30
38	Alternating Currents I	20	Mon., Thurs.		7.00- 8.30
39	Alternating Currents II	20	Mon., Tues., Thurs.		B
40	Alternating Currents III	25	Tues.		B
41	Technical Elect. Measurements I	15	Tues.		7.00- 7.45
42	Technical Elect. Measurements II	15	Tues.		7.45-10.00
43	Central and Sub-Stations	30	Tues.		7.00- 7.45
44	Power Transmission	10	Tues.		8.30-10.00
45	Electricity V				

No.	Course	No. Weeks	Evenings	Time
46	Electric Railways	30	Fri.	7.45- 9.15
47	Heat Engineering	30	Mon.	8.30-10.00
48	Hydraulic Motors	30	Thurs.	8.30-10.00
49	Colloquium	30	Thurs.	8.30-10.00
50	Thesis	30	Mon., Thurs.	B
51	Structural Drawing	30	Wed.	7.00-10.00
52	Structural Design	30	Wed.	7.00-10.00
53	Bridge Design	30	Wed.	7.00-10.00
54	Structural Mechanics	30	Mon., Fri.	7.45- 9.15
55	Theory of Structures	30	Mon., Fri.	7.00- 8.30
56	Strength of Materials	30	Mon., Fri.	8.30-10.00
57	Advanced Structures	30	Mon., Fri.	7.00- 8.30
58	Reinforced Concrete	30	Mon., Fri.	8.30-10.00
59	Topographical Drawing	20	Tues.	7.00- 9.15
60	Stereotomy	10	Mon., Fri.	7.00- 8.30
61	Surveying and Plotting	30	Mon., Fri.	8.30-10.00
62	Advanced Surveying	20	Mon. Fri.	7.00- 8.30
63	Materials of Construction	30	Wed.	7.00- 8.30
64	Foundations	10	Fri.	7.00- 8.30
65	Highways	10	Tues.	7.00- 9.15
66	Hydraulics	30	Thurs.	8.30-10.00
67	Sanitary Engineering	30	Mon., Fri.	7.00- 8.30
68	Municipal Eng. Problems	30	Thurs.	7.00- 8.30
69	Railroad Engineering	30	Mon., Fri.	8.30-10.00
70	Applied Mechanics	20	Mon., Fri.	7.00- 8.30

A. For hours of instruction see Schedule for Chemistry.

B. For hours of instruction see Schedule for Electrical Engineering.

NOTE: For Prices see Schedule of rates.

I. CHEMISTRY AND CHEMICAL ENGINEERING

Schedule

First Year

Period	Monday	Wednesday	Friday
7.00- 7.45	Inorganic Chem. Lect. (18)	Inorganic Chem. Lab. (19)	Inorganic Chem. Lect. (18)
7.45- 8.30	Math. I (1)	"	Math. I (1)
8.30- 9.15	Physics I Lect. (16)	"	Physics I Lect. (16)
9.15-10.00	Physics I Lab. (16)	"	Physics I Lab. (16)

Second Year

Period	Monday	Tuesday	Friday
7.00- 7.45	Math. II (2)	Qual. Anal. Lect. (20) Vol. Anal. Lect. (21)	Math. II (2)
7.45- 8.30	Qual. Anal. Lab. (20) Vol. Anal. Lab. (21)	Qual. Anal. Lab. (20) Vol. Anal. Lab. (21)	Mech. Dwg. II (6)
8.30- 9.15	"	"	"
9.15-10.00	"	"	"

Third Year

Period	Monday	Tuesday	Wednesday
7.00- 7.45	Grav. Anal. Lab. (22) Organ Chem. Lab. (23)	Grav. Anal. Lab. (22) Organ Chem. Lab. (23)	German I
7.45- 8.30	"	"	Grav. Anal. Lect. (22) Or. Chem. Lect. (23)
8.30- 9.15	"	"	
9.15-10.00	"	"	

Fourth Year

Period	Monday	Tuesday	Wednesday
7.00- 7.45	Organ Chem. Lab. (23) Tech. Anal. Lab. (24)	Org. Chem. Lab. (23) Tech. Anal. Lab. (24)	Org. Chem. Lect. (23) Tech. Anal. Lect. (24)
7.45- 8.30	"	"	German II
8.30- 9.15	"	"	Theo. Chem. I (25)
9.15-10.00	"	"	

Fifth Year. For Chemical Engineering Students only

Period	Monday	Wednesday	Friday
7.00- 7.45	Journals (28)	Elect. III (33)	Theo. Chem. II (26)
7.45- 8.30	Indus. Chem. (27)	Elect. IV (34)	Elect. III (33)
8.30- 9.15	Heat Eng. (47)	"	
9.15-10.00	"	"	

NOTE. Numbers in parentheses refer to description of courses, pages 14 to 38.

II. ELECTRICAL ENGINEERING

Schedule

First Year

Period	Monday	Wednesday	Friday
7.00- 7.45	Elect. Ia (29) Elect. Ib (30)	Elect. IIa (31) Elect. IIb (32)	Elect. Ia (29) Elect. Ib (30)
7.45- 8.30	Math. I (1)	"	Math. I (1)
8.30- 9.15	Phys. II Lect. (17) Mech. Dwg. I (5)	"	Phys. II Lect. (17) Mech. Dwg. I (5)
9.15-10.00	Phys. II Lab. (17) Mech. Dwg. I (5)	"	Phys. II Lab. (17) Mech. Dwg. I (5)

Second Year

Period	Monday	Wednesday	Friday
7.00- 7.45	Math. II (2)	Elect. III (33)	Math. II (2)
7.45- 8.30	Wiring, Nat. Code (37) Switchboards (36)	Elect. IV (34)	Elect. III (33)
8.30- 9.15	D. C. Practice (35)	"	D. C. Practice (35)
9.15-10.00	"	"	"

Third Year

Period	Monday	Tuesday	Thursday
7.00- 7.45	Alt. Cur. I (38) Alt. Cur. IIa (39)	Tech. Elect. Meas. I (41) Alt. Cur. IIIa (40)	Alt. Cur. I (38) Alt. Cur. IIa (39)
7.45- 8.30	"	Tech. Elect. Meas. II (42) Alt. Cur. IIIa (40)	"
8.30- 9.15	Heat. Eng. (47)	"	Hydr. Motors (48)
9.15-10.00	"	"	"

Fourth Year

Period	Monday	Tuesday	Thursday	Friday
7.00- 7.45	Inorg. Chem. Lect. (18)	Cent. & sub-sta. (43)	Thesis (50)	Inorg. Chem. Lect. (18)
7.45- 8.30	Thesis (50)	Alt. Cur. IIb (39) Alt. Cur. IIIb (40)	"	El. R'ways (46)
8.30- 9.15	"	"	Thesis (50)	"
9.15-10.00	"	Pr. Trans. (44) Alt. Cur. IIIb (40) Pr. Trans. (44)	Colloquium (49)	"

Fourth Year. Special for 1913-1914 only

Period	Monday	Tuesday	Thursday	Friday
7.00- 7.45	Math. II (2) or Inorg. Chem. (18)	Cent. & sub-sta. (43)	Thesis (50)	Math. II (2) or Inorg. Chem. (18)
7.45- 8.30	Thesis (50)	a.c. & d.c. Mach. Rev. Adv. Lab. & Reports	"	El. Railways (46)
8.30- 9.15	Heat Eng. (47)	Adv. Lab. & Reports Pow. trans. (44)	Thesis (50) Colloquium (49)	"
9.15-10.00	"	"	"	"

NOTE. Numbers in parentheses refer to description of courses, pages 14 to 38.

III. STRUCTURAL ENGINEERING

Schedule

First Year

Period	Monday	Wednesday	Friday
7.00- 7.45	<i>Elem. Mech</i>	Mech. Dwg. II (6)	<i>Elem. Mech</i>
7.45- 8.30	Math. I (1)	"	Math. I (1)
8.30- 9.15	Phys. I Lect. (16)	"	Phys. I Lect. (16)
9.15-10.00	Phys. I. Lab. (16)	"	Phys. I Lab. (16)

Second Year

Period	Monday	Wednesday	Friday
7.00- 7.45	Math. II (2)	Struct. Dwg. (51)	Math. II (2)
7.45- 8.30	Struct. Mech. (54)	"	Struct. Mech. (54)
8.30- 9.15	"	"	"
9.15-10.00	"	"	"

Third Year

Period	Monday	Wednesday	Friday
7.00- 7.45	Theo. Struct. (55)	Struct. Design (52)	Theo. Struct. (55)
7.45- 8.30	"	"	"
8.30- 9.15	Str. of Materials (56)	"	Str. of Materials (56)
9.15-10.00	"	"	"

Fourth Year

Period	Monday	Wednesday	Friday
7.00- 7.45	Adv. Struct. (57)	Bridge Design (53)	Adv. Struct. (57)
7.45- 8.30	"	"	"
8.30- 9.15	Concrete (58)	"	Concrete (58)
9.15-10.00	"	"	"

NOTE. Numbers in parentheses refer to description of courses, pages 14 to 38.

IV. RAILROAD ENGINEERING

Schedule

First Year

Period	Monday	Wednesday	Friday
7.00- 7.45		Mech. Dwg. II (6)	
7.45- 8.30	Math. I (1)		Math. I (1)
8.30- 9.15	Phys. I Lect. (16)	"	Phys. I Lect. (16)
9.15-10.00	Phys. I Lab. (16)	"	Phys. I Lab. (16)

Second Year

Period	Monday	Tuesday	Friday
7.00- 7.45	Math. II (2)	Topo. Dwg. (59)	Math. II (2)
7.45- 8.30		Highways (65)	
8.30- 9.15	Survey & Plot (61)	"	Survey. & Plot (61)
9.15-10.00	"		"

Third Year

Period	Monday	Wednesday	Friday
7.00- 7.45	Adv. Survey. (62)	Mater. of Const. (63)	Adv. Survey (62)
7.45- 8.30	Stereotomy (60)	"	Stereotomy (60)
8.30- 9.15	Railroad Eng. (69)		Railroad Eng. (69)
9.15-10.00	"		"

NOTE. Numbers in parentheses refer to description of courses, pages 14 to 38.

V. MUNICIPAL ENGINEERING

Schedule

First Year

Period	Monday	Wednesday	Friday
7.00- 7.45		Mech. Dwg. II (6)	
7.45- 8.30	Math. I (1)	"	Math. I (1)
8.30- 9.15	Phys. I Lect. (16)	"	Phys. I Lect. (16)
9.15-10.00	Phys. I Lab. (16)	"	Phys. I Lab. (16)

Second Year

Period	Monday	Tuesday	Friday
7.00- 7.45	Math. II (2)	Topo. Dwg. (59)	Math. II (2)
7.45- 8.30		Highways (65)	
8.30- 9.15	Survey & Plot (61)	"	Survey & Plot (61)
9.15-10.00	"	"	"

Third Year

Period	Monday	Wednesday	Friday
7.00- 7.45	Applied Mech. (70)	Mater. of Const. (63)	Applied Mech. (70)
7.45- 8.30	Stereotomy (60)	"	Stereotomy (60)
8.30- 9.15	Concrete (58)		Concrete
9.15-10.00	"		"

Fourth Year

Period	Monday	Thursday	Friday
7.00- 7.45	Sanitary Eng. (67)	Municip. Eng. Prob. (68)	Sanitary Eng. (67)
7.45- 8.30	"	"	Foundations (64)
8.30- 9.15	Heat Eng. (47)	Hydraulics (66)	Pract. Elect.
9.15-10.00	"	"	"

NOTE. Numbers in parentheses refer to description of courses, pages 14 to 38.

DEPARTMENT OF MATHEMATICS

DIRECTOR: THOMAS E. PENARD, S. B.

INSTRUCTOR: MR. M. F. PINKHAM.

The importance of mathematics as a means of mental discipline, and as a necessary basis for those intending to pursue engineering as a profession, cannot be overestimated.

Students taking the regular courses in Chemistry and Engineering are given two years instruction in applied mathematics, as outlined in Mathematics I and II. Special attention is called to these two courses in practical mathematics, which are intended to cover the field in so far as mathematics is ordinarily employed in the usual engineering computations.

Courses in advanced applied mathematics will be given provided a sufficient number of men apply to form a class.

1. **Mathematics I.** MR. PENARD.

Preparation: Arithmetic.

This course, of two hours per week during the first year, is designed primarily for students taking the regular engineering courses; it is hoped, however, that it will be found adapted to the needs of others who wish to obtain a practical knowledge of elementary mathematics. The student is assumed to be thoroughly familiar with the fundamental operations of arithmetic.

Algebra, including definitions and notation, fundamental operations, factoring, fractions, simple and quadratic equations, with applications to problems chosen from electricity and mechanics, formulas.

Logarithms, the use of slide rules, discussion of precision and rules for significant figures.

Geometry including useful theorems, relating to plane figures, without proofs, measurements of triangle, polygons, circle, polyhedrons, cylinder, cone and sphere, definitions of ellipse, hyperbola and parabola.

2. **Mathematics II.** MR. PENARD.

Preparation: Mathematics I, (1), or equivalent.

This course of two hours per week during the second year, like Mathematics I, of which it is a continuation, is designed primarily for students taking the regular engineering courses,

but may be taken to advantage by those regularly employed in engineering work who wish to obtain a more thorough grasp of applied mathematics.

Trigonometry including circular measure, co-ordinates, trigonometric ratios, formulas, law of sines, law of cosines, solution of right and oblique triangles, applications to problems in Physics and Engineering.

Plotting of functions, interpolation, the straight line, curves represented by various equations, graphic solution of equations, determination of laws from the data of experiments, simplification of formulas.

Rate of increase, differentiation, determination of maxima and minima by differentiation, integration, definite integrals, determination of mean value, area and volume by integration, centre of gravity, moment of inertia, partial differentiation.

3. Trigonometry. MR. PENARD.

Preparation: Mathematics I, or equivalent.

This is a more extended course than that outlined in Mathematics II and is intended for students who wish to obtain a thorough knowledge of plane trigonometry, without taking other subjects included in Mathematics II. It is especially adapted to the needs of students preparing for college examinations.

4. Logarithms and Slide Rule. MR. PINKHAM.

A thorough course of 20 hours in the theory and use of logarithms and their application to the slide rule. Personal instruction will be given in the manipulation of slide rules in connection with all kinds of computations to which they are adapted.

Analytic Geometry and Calculus.

See Mathematics II

DEPARTMENT OF DRAWING

INSTRUCTORS: MR. HENRY BARRETT, JR., MR. JAMES BROUGH,
A. L. GARDNER, S.B., DANIEL KNOWLTON, S.B., MR. C.
H. B. MORSE, MR. GEORGE A. TRUELSON.

The courses in Mechanical and Architectural drawing, as outlined, afford the essentials of drafting for those contemplating office work and are equally valuable and necessary to those working in the allied trades.

The art courses are varied and the work is thorough and complete, and of a high order. Great care is taken to develop the student along the line of his natural inclinations, and, so far as possible, to have the work of the school bear directly upon his daily employment and other courses attended.

5. Mechanical Drawing I. MR. GARDNER.

A course for the first-year industrial students in mechanical drawing as follows:

General instruction in the use of drawing instruments as T square triangles, etc. The course is based on sketches arranged for industrial students, by Mr. H. W. Smith of Pratt Institute, and includes simple projections in the form of working drawings, carefully dimensioned, nuts and screws, and oblique projections.

6. Mechanical Drawing II. MR. GARDNER.

This course consists of work in the drawing room, occupying one evening a week throughout the entire first year. The drawing is of an elementary character, beginning with instruction in the use of instruments and the fundamental rules for executing engineering drawings. In conjunction with the drawing, the elementary principles of descriptive geometry and projections are studied, and the student prepares a number of plates illustrating the reproduction of objects in the shape of working drawings.

7. Lettering. MR. GARDNER.

Freehand lettering is of the utmost importance to all engaged in any line of drawing. No matter how well made a drawing may be, poor lettering will ruin its appearance, so that the student who expects to ever become a really valuable man, must be expert, not only in draughting, but in lettering also. No student will be graduated who cannot letter well.

8. Machine Drawing. MR. GARDNER.

The aim of the course is to teach the proper way of making the necessary dimensioned drawings for use in practice. The instruction includes: (a) The making of sketches of the parts of a machine from measurements; (b) the detail scale drawing from the sketches and a tracing; (c) an assembly drawing of the machine.

9. Architectural Drawing I. MR. TRUELSON.

An elementary course, including the fundamental prin-

ciples underlying all kinds of mechanical and architectural drawing: geometrical problems; orthographic and isometric projections and the orders of architecture.

In connection with this course the instructor will outline a course of reading in architectural history.

10. Architectural Drawing II. MR. TRUELSON.

Practical architecture and details of construction. In this course the student is taught the component parts of buildings. Typical details of construction are drawn to a large scale and in isometric projection. This is preparatory to the drawing of complete plans, elevations and working drawings of some elementary problem, which constitutes the work of the latter part of the year.

Special Students

Students desiring special work in Architectural Drawing, not outlined above, should consult with the instructor.

11 and 12. Freehand Drawing. MR. BROUGH.

Considering the great importance of the study of freehand drawing to all who are engaged in, or anticipate being engaged in any industrial art, artistic trade, or profession, we offer a very complete course in this line, and call attention to the splendid advantages provided.

The work is adapted to the requirements of each individual student, so far as is practical and consistent with a thorough training in freehand drawing. There are two classes in both freehand drawing and industrial design.

11. Class I. The work of this class is intended to meet the wants of those students who have no previous knowledge of freehand drawing and is recommended to all students who intend to become craftsmen, designers, architects, or artists, and also to others who may wish to take up the study as an accomplishment. The work will consist of drawing from typical models, by which students learn a sense of proportion and the principles of perspective; groups of still life for the study of composition and color; also drawing of historic ornament, and details of the human figure from the cast, by which students are taught to observe form, and the principles of light and shade.

12. Class II. The course of study in this class is of a more advanced nature than that of Class I, and in addition to the

more complicated forms of ornament, the full-length human figure from the antique is added, also rendering in pen and ink and pencil, advanced shading in charcoal, painting groups of still life in monochrome and polychrome, in oil and water colors.

13. Industrial Design and Interior Decoration. MR. BROUGH.

The courses in industrial design and interior decoration are specially helpful to those students who are already engaged in, or anticipate being engaged in such arts and crafts, as wood and stone carving, wrought and bent-iron work, brass and copper work, stained glass, furniture and drapery, interior decoration, book covers, wall paper, fabrics and other allied industrial arts. No limitation is placed upon the student who shows ability to take up the work prescribed for the class he wishes to enter, and students who so desire may spend part of their time in the free-hand class and part in the industrial design and interior decoration class, without extra charge. The instructor is a certified art master and one of the leaders of the profession. Students in industrial design are recommended to take architecture.

Class I. The studies in this class include the work of the freehand drawing in Class I, with the addition of special studies given for the purpose of design, such as a systematic study of the various styles of historic ornament, studies of animal and plant form, and the elementary principles of design.

Class II. Students who have an elementary knowledge of drawing and design are considered eligible for this class and are taught the more advanced principles of composition, form and color in design, also rendering the same in various mediums, including charcoal, pencil, pen and ink, water and oil colors.

14. Illustrating and Cartooning. MR. MORSE AND MR. BARRETT.

This class is under the supervision of Mr. C. H. B. Morse, assisted by Mr. Barrett.

The class meets three times a week, Tuesday, Thursday and Saturday. Mr. Morse will criticise on Tuesday and Saturday, and Mr. Barrett will have charge on Thursday. The first term the students will draw from the model to gain knowledge in proportions, anatomy, and the use of the different mediums used in rendering the figure. Weekly compositions for illustrations and cartoons will be submitted and criticised. The model will be used in working out the successful compositions.

The second term, the model will pose for shorter sketches and will be drawn while in motion to secure natural and life-like attitudes. The compositions and cartoons will be also continued, and the advanced students will receive instruction in facial expressions and character. The individuality of each pupil will be encouraged, and each will be advised as to the best use of his particular ability.

Structural Drawing. See Dept. of Structural Engineering.

Topographical Drawing. “ “ “ “

15. Plan Reading and Estimating. MR. DANIEL KNOWLTON.

This is a course especially designed for carpenters, builders, contractors, architects and draughtsmen. It is not a course in drawing, but at once enters into the actual reading of plans, taking off quantities and estimating. A knowledge of drawing is not necessary, and only simple arithmetic will be used. The instructor is one of the ablest estimators in the country, and a man capable of handling any phase of the work.

The course will cover thirty evenings' study from architects' plans and specifications, and includes short lectures each evening, covering the general building business and kindred subjects. The course will cover preliminary work in building surveys, shoring and excavation, masonry, cut stone, carpentry and hardware, and may touch upon plastering, structural steel, heating and plumbing, painting, glass and electric work.

This course will not be given in the year 1913-1914, unless a sufficient number of applicants register for it.

DEPARTMENT OF PHYSICS

INSTRUCTOR: MR. WALTER A. BALDWIN.

16. Physics I. MR. BALDWIN.

This course appeals strongly to men engaged in technical work. Instruction is given in the practical application of physical laws. Problems are given throughout the year to test the pupil's knowledge of these laws. A fully equipped laboratory, accommodating thirty students working at one time, makes it possible to give the best of instruction. The exercises will be selected from the following subjects:

Mechanics

Density and specific gravity, simple machines, parallelogram of forces, friction, pendulum, strength of materials, laws of elasticity, liquids and gases.

Heat

Thermometry-coefficients, laws of expansion, specific heat, latent heat.

Light

Reflection, refraction.

Sound

Velocity, wave length, pitch.

Electricity

Magnetism, cells, electromotive force, resistance.

This course is especially fitted for those who wish to take the College Entrance examinations, and for such students a series of additional exercises is planned covering the work very thoroughly.

17. Physics II. MR. BALDWIN.

This course is especially designed for students taking the course in Electrical Engineering. It is identical with Physics I, but omits portions relating to electricity and magnetism.

DEPARTMENT OF CHEMISTRY AND CHEMICAL ENGINEERING

DIRECTOR: ELLWOOD B. SPEAR, A.B., PH.D.

INSTRUCTORS: EDWARD MUELLER, S.B., PH.D. AND MR.
SAMUEL STRAHAN.

The wonderful advance in the application of science to the arts during the past few years has caused a great demand for technically trained men. Nearly every large manufacturing concern now employs chemists regularly, or else has experts whom it can consult at short notice. The scientific and technical schools are each year sending out large classes of young men, especially trained to meet this demand. For a young man to acquire this education requires four years at a scientific, or technical school, in addition to the four years necessary for preparation at the secondary school, and an outlay of from two to three thousand dollars. These necessary expenditures of

time and money are such that many young men, who are mentally capable of taking such courses, are obliged to give up their ambitions and fill inferior positions.

Formerly the practical knowledge which young men acquired by contact with their work was sufficient, but today the degree of specialization is such that a theoretical knowledge is essential to success in many industries where chemical processes are utilized.

There are many men who, by close application to the practical side, have acquired responsible positions in technical industries, but are unfamiliar with the theoretical side of their chosen work.

Such men are unable to advance in their special lines, because they cannot read the many valuable books written on special technical subjects, which presuppose a general knowledge of the theory of chemistry.

At the present time, the requirements of admission to the higher institutions of learning, even for special students, are such that the doors are practically closed to these men, although many of them could take special courses with profit. Again, the only available hours for such men are during the evening. There is a demand, therefore, for a systematic evening course in chemistry, which will be open to men engaged at the present time in technical industries.

The school offers a thorough course in the general principles and applications of inorganic, organic and analytical chemistry, sufficiently complete to enable students to pursue their work with intelligence; to correlate theory and practice; to read technical works with profit; to test the quality and purity of chemicals and to become familiar with the laboratory methods of the trained chemist.

To the student who can pursue his studies an extra year, and who has had the necessary training, the school offers a course in chemical engineering. It is the aim of this course to prepare men to aid in the operation of industries based on chemical principles.

The laboratories in the new building on Huntington Avenue are fitted with an excellent equipment in up-to-date apparatus, to give thorough instruction in all the courses offered.

Students are especially urged to take the entire work on

the schedule of each year. A good grounding in mathematics, physics and German, is essential to success in the chemical subjects of the third and fourth years.

Students who cannot take the entire chemical, or chemical engineering, courses may enroll for any portion of the same, provided they can satisfy the head of the department that they can pursue the work with profit.

A laboratory deposit of three dollars for the first year, and four dollars for all other years, must be paid before desks will be assigned. Students who have not checked up their desks by the end of the school year will be charged one dollar extra.

The School makes an effort to secure positions for those who have successfully completed the course in chemistry, or chemical engineering.

18. Inorganic Chemistry.

DR. SPEAR AND ASSISTANT.

A course of sixty experimental lectures on the fundamental laws and principles of inorganic chemistry. The course aims to familiarize the student with the properties and preparation of the following elements and their most important compounds:—oxygen, hydrogen, the halogens, sulfur, nitrogen, phosphorus, carbon, silicon, the alkali and alkaline earth groups, iron and aluminium. The course is to be taken in conjunction with (19).

Text book:

General Chemistry for Colleges, Smith.

19. Inorganic Chemistry Laboratory.

DR. SPEAR AND ASSISTANT.

A laboratory course of thirty weeks, 120 hours, in which the student is expected to verify and illustrate the facts and principles that have been discussed in the lectures. To be taken in conjunction with (18).

Text book:

Laboratory Experiments in Inorganic Chemistry, Spear.

Courses (18) and (19) are well adapted to the needs of those who wish to take the College Entrance examinations.

20. Qualitative Analysis.

DR. SPEAR AND MR. STRAHAN.

Preparation, (18) and (19), or an equivalent.

A practical course in qualitative analysis of 20 weeks, 140 hours duration, beginning in September. The course relates to the identification of the common metallic elements and the ordinary acids.

Each student is expected to make complete and accurate analyses of various mixtures, alloys and chemicals used in the industries. The laboratory work is supplemented by lectures and conferences.

Text books:

General Chemistry for Colleges, Smith;
Qualitative Chemical Analysis, A. A. Noyes.

21. Volumetric Analysis.

DR. SPEAR AND MR. STRAHAN.

Preparation, (18), (19), (20), or equivalent.

A course of 10 weeks, 70 hours, beginning in February, on volumetric determinations, involving the use and the standardization of burettes, pipettes, and measuring flasks. The course includes alkalimetry, acidimetry, indicators, oxidimetry, iodimetry, chlorimetry. The laboratory work is supplemented by lectures and conferences.

Text book:

Quantitative Chemical Analysis, Talbot.

22. Gravimetric Analysis.

DR. MUELLER AND ASSISTANT.

Preparation, (18), (19), (20), (21), or equivalent.

A course of 15 weeks, 135 hours, devoted to the principles and practice of gravimetric analysis. The laboratory work is supplemented by lectures and conferences.

Text books:

Quantitative Chemical Analysis, Talbot;
Analytical Chemistry, Treadwell and Hall, Vol. 2.

23. Organic Chemistry.

DR. MUELLER AND ASSISTANT.

Preparation, (18), (19), (20), (21), (22).

A course consisting of 270 hours, beginning in January of the third year, and continuing into the fourth. The course is devoted to lectures, conferences and laboratory work, on the principles of organic chemistry, as illustrated by the methane and benzene derivatives. The student is required to prepare

in the laboratory a number of organic compounds, selected to show the characteristic reactions, and to give training in the practical separation and purification of organic substances. After this synthetic work, the students are given a practical course in organic analysis.

Text books:

Holleman, Text-book of Organic Chemistry. Gatterman, Practical Methods in Organic Chemistry, translation by Schöber. Laboratory notes by the instructor.

24. Technical Analysis.

DR. MUELLER AND ASSISTANT.

Preparation, (23), or an equivalent.

A course of 135 hours, beginning in January of the fourth year, on the following:

Analysis of gases.

Analysis and testing of mineral, animal and vegetable oils.

The origin, manufacture, properties, uses and analysis of the various fuels, and the determination of the heat value of fuels by the use of a calorimetric bomb.

25 and 26. Theoretical Chemistry I and II.

DR. SPEAR, DR. MUELLER.

Preparation, (2), (20), (21), (22).

A course of sixty lectures and conferences on chemical equilibrium and electro-chemical topics. The course will include lecture experiments and discussion of problems on the law of mass action applied to the rate and equilibrium of chemical reactions, the effect of temperature and pressure, the conduction of electricity by solutions, the production of electricity by chemical change, the electromotive force of voltaic cells and single potential differences. Problems for independent solution by the student will also be given.

27. Industrial Chemistry.

Preparation, (20), (21), (22), (23).

A course of thirty lectures and conferences on the more important chemical processes. Attention is given to many operations of a general nature common to chemical industries, such as crushing, grinding, filtration, evaporation, distillation, etc., and to the apparatus employed in these processes. Some of the more important industries will be taken up in detail.

Text book:

Thorp, Outlines of Industrial Chemistry

28. Journals.

The class will meet once a week, during the fifth year, for an entirely informal discussion of various matters appearing from time to time in the Technical press.

DEPARTMENT OF ELECTRICAL ENGINEERING

DIRECTOR: W. LINCOLN SMITH, S.B.

INSTRUCTORS: LOREN DOWNS, S.B., A. L. GARDNER, S.B.,

MR. F. G. HARTWELL, W. N. SMITH, M.E.

The school offers a thorough course in Electrical Engineering, combining theory with practice.

The laboratory equipment is very complete and suitable for teaching in a very effective manner. The object of all the laboratory work is to have the student expand the knowledge he has received from the lectures, and reading, by learning through his finger tips; to have him absolutely handle the object under discussion; to adjust, measure, and test electrical machinery; to become familiar with dynamos, motors, electric wires, and, in fact, to get an intelligent conception of the entire problem from a practical standpoint. In addition to the foregoing, however, it is aimed to supply sufficient theory so that the student may know why certain things are done, enabling him thereby to become a skilful operator and one capable of growth and development. When a man is in earnest, and attends regularly, he can acquire an intelligent conception and a working knowledge which has a direct and absolute commercial value.

In addition to the above regular courses of the School, it is intended that, if sufficient men apply to cover the cost, courses will be given on the subject of wireless telegraphy, induction coils and firing systems for gasolene engines, etc.

Also should a sufficient number of men apply to warrant the formation of a class, it is intended to arrange for a lecture and laboratory course in telephony. This, however, would hardly be warranted for a less number than fifteen, and twenty would be better, as the expense of instruction and laboratory equipment would be large.

Students in the regular second-year course would not find it possible to take this in addition to their regular work, but might substitute it for a part of the same, after considering the matter with the Dean.

Although the second and third year courses of the long technical course are integral parts of the same, the work has been planned, so far as possible, to allow of any man having sufficient knowledge, entering at any point as a regular student, after satisfying the instructors of his capacity to carry on the work without hindrance to the other men; or, as a special student for such particular parts of the work as he may desire. Thus he may take either the whole of the second-year work, or any one, or more, of the courses which appeal to him, and the same in the third year. The expense will be arranged in each individual case according to its particular nature.

A special fourth year course will be given during 1913-1914, for the benefit of former students who wish to take subjects to complete the regular four-year course as now arranged.

29. Electricity Ia. MR. HARTWELL.

A lecture course of 15 weeks duration on the following subjects:—Ohm's law, power measurements, batteries, annunciators, burglar alarms, gas lighting systems, electric wiring devices, new and old house work, moulding, conduit, knob, tube and cleat work, arc and incandescent lamps, two and three wire systems, different types of switches and their use, method of installing, testing and locating trouble.

30. Electricity Ib. MR. HARTWELL.

A lecture course of 15 weeks duration on the following subjects:—Different types of motors and controlling devices, methods of connecting and installing the same, fitting and setting brushes and common troubles and their causes, generators, different types, and connections for the same, how to take care and operate, common troubles and their causes, switchboards, different devices used on switchboards and their use, connections for all kinds of direct current, two and three-wire switchboards, booster and balancer sets explained, and connections given, location of generator and switchboards.

31. Electricity IIa. MR. HARTWELL.

A laboratory course of fifteen weeks duration covering subjects given in electricity Ia.

32. Electricity IIb. MR. HARTWELL.

A laboratory course of fifteen weeks duration covering subjects given in Electricity Ib.

33. Electricity III. MR. W. L. SMITH.

This course of thirty weeks, sixty hours, consists of Lectures on the general principles of Electricity and Magnetism, including such matters as Resistance, Inductive reactance, Capacity reactance, Voltage and Current relations in complicated networks of circuits. The various Electrical Units of Measurement, and their dimensional equations, etc., in addition to the usual consideration of the Electrical phenomena given in the Electrical section of a general physics course, up to, and including the principle of Electromagnetic-induction, the intention being to lay a thorough foundation for the future more specialized branches of the course.

34. Electricity IV. MR. W. L. SMITH AND MR. HARTWELL.

This is a Laboratory Course of thirty weeks, ninety hours, running parallel with Elect. III and Direct Current Practice, and designed to emphasize the understanding of the principles studied in these, as well as to give the student practice in the handling of instruments and the making of observations preparatory to the later courses which involve the precise testing of electrical machinery. Thus it includes such experiments as a study of the bridge principle, determination of a current by electrolysis, resistance by Ohm's law, magnetization of iron, measurement of the self induction of a coil, of the capacity of a condenser etc., on the one hand; and on the other, such experiments as the relation of speed and E. M. F. in an armature running at constant speed in a constant field; Variation of E. M. F. with field strength; potential distribution about the commutator; variation of candle power with voltage in the various types of incandescent lamps, operation of arc lamps etc.

35. Direct Current Practice. MR. W. L. SMITH, MR. HARTWELL AND MR. DOWNS.

This Course of thirty weeks, one hundred and twenty hours, begins at the point where Elect. III leaves off and discusses the theory of direct current generators and motors, winding of D C Armatures,—and in general a careful and detailed consideration of the application of direct currents to the

various industrial processes is given, except in so far as relates to railway work, the consideration of which is deferred to the special course on that subject. It is essentially a lecture course, though many of the lectures may take place in the laboratory, or power house, about the machine under consideration.

36. Switchboards and Apparatus. MR. HARTWELL.

This is a lecture course of fifteen hours, in which is discussed the apparatus used upon switchboards, the planning of switchboards, connecting up, etc. It is not intended to consider in this course the complicated switchboards and devices used in large stations, but rather those used in small plants for public supply, isolated private plants, and control panels, as for stage lighting, etc.

37. Wiring and the National Code. MR. HARTWELL.

The consideration of appliances used in wiring of buildings and the methods of running circuits (so far as the electrical operation of the same is concerned) has already been taken up as a subdivision of Electricity I. The present course of fifteen hours is given over to the consideration various accepted methods of installing wires the various rules of the National Electrical Code and their reason for being. This course will be a very thorough and valuable consideration of the Code it being given by Mr. Hartwell, a member of the Executive Committee of the National Association of Electrical Inspectors, and under the immediate supervision of Mr. Smith, who is the Secretary of the same Association, as well as of the Mass. Association of Municipal Electrical Inspectors. As a result of this, mooted points of controversy over the exact meaning of the various sections of the Code, which arise between wiremen and inspection departments all over the country, as well as the decision of the chiefs of twenty-four of the most important inspection jurisdictions, both municipal and Fire Insurance Exchanges, are immediately available in the Class room. The course deals only with inside wiring and not with street distribution systems.

38. Alternating Currents I. (Theory of Alternating Currents). MR. DOWNS.

Preparation: Elec. III.

This course of eighty lectures and recitations, given in the third year, concerns itself with the general theory of alternating

current circuits, and the application of these principles to various engineering problems. In connection with the work, considerable emphasis is attached to the solution of problems selected with particular reference to their engineering application.

39. Alternating Currents II. (Alt. Current Machinery).

MR. DOWNS.

Preparation: Alternating Currents I.

This course of lectures, recitations, and problems, IIa consisting of forty periods in the third year, and IIb of twenty periods in the 4th year, is devoted to a careful discussion of the various types of alternating current machinery for the generation, transmission, and distribution of power. The special properties of each machine are considered, for the machine, as a unit, and also when it is a part of any electrical system. Some of the general considerations concerning long distance transmission are also discussed.

40. Alternating Currents III. MR. DOWNS.

IIIa. A. C. Machinery Laboratory and Reports.

IIIb. Advanced D. C. and A. C. Laboratory and Reports.

Preparation A.C. IIa and b

This course consisting of sixty hours in the third year (A.C. IIIa), and thirty hours in the 4th year (A.C. IIIb) is a continuation of Elec. IV Lab. It includes such tests as efficiency, heating, regulation and determination of characteristics for alternating current machinery. For the advanced laboratory work tests will be made on the power plant of the Y. M. C. A. buildings. In this course, particular attention will be paid to the reports, which are in every case to be complete engineering reports of the work undertaken. The work in the laboratory will be supplemented by individual conferences.

41. Technical Electrical Measurements I. MR. W. L. SMITH.

This is a lecture course of fifteen hours, in which are discussed the principles of various methods of Electrical Measurement, as well as the different instruments used, particular attention being given to the precision of the methods, the sources of error in instruments, and means for their detection and elimination.

42. Technical Electrical Measurements II. MR. W. L. SMITH.

This is a Laboratory Course, of forty-five hours, parallel

with the former, the various experiments including such as the Correct use of the Wheatstone Bridge, the Slide Wire Bridge, Insulation Resistance Testing, Calibration of Wattmeters, Calibration of Voltmeters and Ammeters by use of the Potentiometer, etc., in each case careful application of the principles of Precision of Measurements being required.

43. Central and Sub-Stations. MR. DOWNS.

A course of Lectures, thirty hours, dealing with the layout, construction and operation of electric power generating stations, for the general distribution of electricity for light and power purposes, except that the peculiar characteristics of Railway Power stations are not considered. In this course will be taken up the switchboard devices necessary to this type of plant.

44. Power Transmission. MR. W. L. SMITH.

In this course of twenty hours, will be considered the economic problem of power transmission, the principles governing the design of transmission lines, the construction of the line and the National Code Rules governing such lines, and some of the more important municipal and statutory requirements.

45. Electricity V. MR. W. L. SMITH AND MR. DOWNS.

A Laboratory Course of advanced Electrical Testing, both Alternating and Direct, in which use will be made of the special apparatus in the Laboratory, and also of the machines and apparatus installed in the local generating and distributing plant of the Association. It includes experiments on Characteristics of Machines, Efficiency tests on Direct Generators and Motors by all the leading methods, on Alternating Generators, Motors and Transformers, Single phase, three phase and quarter phase, Heating and Regulation tests, etc.

46. Electric Railways. MR. W. N. SMITH.

A course of sixty hours, including lectures and practical examples of the following subjects: Train Resistance, Railway Motors and their characteristics, determination of equipments by speed time curves and train sheets, car construction and equipment, electric locomotives, rail bonding, trolley and third rail construction, design of feeder and transmission lines, substation and power station equipment, power system determinations, storage battery traction, and steam railroad electrification by direct and alternating currents.

47. Heat Engineering: Thermodynamics and Boilers. MR. GARDNER.

A course of sixty hours in the study of the principles of thermodynamics; a discussion of the properties of gases, saturated and superheated vapors, especially of air and steam; of the flow of fluids through orifices, nozzles, pipes and meters, a discussion of the action of the steam injector; a study of the various cycles of the hot air, internal combustion and steam engines of the turbine, air compressor and refrigerator systems. These engineering applications are treated from the physical, analytical and graphical points of view, so as to give the student a good foundation in the principles of thermodynamics, in the solution of actual heat engineering problems. The course also includes a study of the simple, compound and multiple expansion steam engine, of the different types of gas engines, of the gas producer, of compressed air and refrigerator machines, and the methods of testing such machines.

The latter part of the course includes a study of the various types of steam boilers and the different kinds of power plant apparatus, including fans, blowers, economizers, condensers, feed pumps, etc. A short discussion of the construction and stability of chimneys is also given.

48. Hydraulic Motors. MR. GARDNER.

A course of sixty hours, mainly recitations covering the principles of hydrostatic and hydrodynamic pressure, the flow of water through open channels, pipes, orifices and nozzles and over weirs. The time is principally given however, to a study of impulse wheels and reaction turbines, with reference to their proper construction, regulation and testing, and to the various sources of loss of energy in their operation.

49. Colloquium. MR. W. L. SMITH AND MR. DOWNS.

The class will meet once a month, during the fourth year, for an entirely informal discussion of various matters appearing from time to time in the Technical press. Subjects for discussion will be assigned to the various students several weeks ahead, and upon the allotted evening, a fifteen minute talk will be given by the student to whom the subject has been assigned and the remainder of the time to an open discussion of the same, the instructor acting as moderator of the meeting. This work, too,

will be of great value to the student as a means of learning to absorb a subject, impart his information to others, and to maintain his position effectively in argument, as well as learning to acknowledge a mistake, gracefully, yield to the logical scientific correctness of another's argument, and in general, to gain a more scientific and reasoning mental attitude.

50. Thesis.

During the final year, each student in order to qualify for a diploma, must prepare and present a report upon some piece of original work, investigation of some piece of machinery, consideration of some practical problem, or similar subject, the students working either alone or in pairs, and at such time as they please, within limits, the subjects being selected in consultation with one of the instructors, who will have immediate supervision of the work.

The object of this work is to develop the student's powers of original investigation and to teach the principles upon which the study of special problems of various kinds should be approached. It is hardly expected that the immediate results of the investigation will be of great value, in view of the time allowable, considered as contributions to engineering knowledge, but it is expected and believed that the value to the student himself will be very great.

DEPARTMENT OF STRUCTURAL ENGINEERING

DIRECTOR: ROYALL D. BRADBURY, S.B.

INSTRUCTOR: JAMES M. BARKER, S.B.

The four years' course in structural engineering covers thorough instruction in mathematics, mechanics and the theory and practice of drafting, detailing, estimating and designing. Thorough instruction is given by means of lectures and classroom work in the important theoretical and practical principles of design, supplemented by the execution of detail drawings in the drafting room.

51. Structural Drawing.

The course in structural drawing occupies one evening a week throughout the entire second year. The course consists of preparation of drawings, representing elementary structural

Students wishing to take separate courses may do so on approval of the Dean.

59. Topographical Drawing.

This course of twenty weeks in the second year, is primarily designed to give training in the interpretation and drawing of topographical maps. It consists of three hours per week in the drawing-room, devoted to the study of the different conventional signs employed, and each student is required to make a number of plates, and to become reasonably proficient in the preparation of such maps. Particular attention is given to the study of contour maps, and the solution of problems relating thereto.

60. Stereotomy.

A course of four hours per week, during the last ten weeks of the second year, in the applications of Descriptive Geometry to the making of drawings in connection with the design of masonry structures, such as intersecting arches and walls, abutments, piers and culverts.

61. Surveying and Plotting. MR. HOWARD.

Preparation: Trigonometry (3) or Math. II (2)

The course in surveying consists of four hours instruction each week during the second year, in the theory of plane surveying, with field exercises on Saturday afternoons in the Fall and Spring.

During the first term, the field work consists of practice in the use of the transit and tape in making surveys for determining areas and for making plans. The class work includes methods of computing areas, subdividing land, and all of the common problems of plane surveying.

The second term is devoted chiefly to drawing. Students are required to plot a survey of a city lot, on a scale of 40 feet to an inch, to draw a plate of conventional signs used in topography, and to plot a topographical map on a scale of 100, or 200 feet to an inch.

In the spring, the field work consists of practice in using the level for establishing bench marks, running profiles, cross sectioning, etc. The class work includes problems in the use of contour maps, plotting profiles, estimates of earthwork, etc. If time permits, instruction is given in stadia and plane table surveying.

62. Advanced Surveying. MR. HOWARD.

Preparation: Surveying and Plotting (61) or equivalent.

This course occupies four hours per week during the first twenty weeks of the third year and covers the following subjects:

Triangulation: reconnoissance, base-line measurement, signal building, use of heliotropes, measurement of angles, calculation of triangles, calculation of geodetic positions.

Astronomical Observations: observations for latitude, observations for time and longitude, determination of azimuth.

Leveling: precise spirit leveling, trigonometric leveling, barometric leveling.

Topographic Methods: transit and stadia method, plane-table method.

Hydrographic Surveying: methods of locating soundings, use of sextant, measurement of stream flow.

Map Projections: study of the principal projections used in constructing maps.

Exercises in fieldwork will be held Saturday afternoons.

63. Materials of Construction.

A course of two hours per week during the third year, taking up a consideration of the properties of the various materials used in engineering construction, such as wood, iron, steel, brick, stone, cement and concrete.

64. Foundations.

A course of two hours per week during the last 10 weeks of the fourth year.

The subjects treated in this course are as follows: Building stones and concrete, bearing power of different kinds of soil, examination of the site, designing the footings, whether of masonry, or of steel and concrete, independent piers, pile foundations, compressed air processes, freezing processes, retaining walls, together with some details of buildings for industrial purposes, constructed of steel or of reinforced concrete.

65. Highways.

A course of three hours per week during the last ten weeks of the second year, in which are treated the following subjects:

The construction of roads and city streets, the problems of drainage and maintenance, qualities of trap rocks, good gravel, binding materials, paving blocks and bricks, concrete

foundations, and the uses of asphaltic oils and other bituminous materials.

66. Hydraulics.

A course of two hours per week during the fourth year. The course consists of two parts. The first is devoted to the study of theoretical hydraulics dealing with hydrostatic and hydrodynamic pressure, the flow of water through channels, pipes, orifices and nozzles and over weirs. The second part deals with such practical problems as the study of stream flow and storage and the development of water power.

67. Sanitary Engineering.

A course of eighty hours during the fourth year, consisting of the study of water supply and sewage disposal and their relation to public health, the sources of water supply, tests for purity, bacteria, etc., the design of a sewage disposal system, septic tanks, filter beds, and the collection and disposal of garbage wastes.

68. Municipal Engineering Problems.

A course of two hours per week during the fourth year dealing with various engineering problems encountered by town and city engineers such as construction of sewers, retaining walls, bridges, grade crossing problems, making of contracts, and writing specifications for various construction work, methods of inspection, and handling of public service properties, such as poles, lines, conduits, tracks, etc.

69. Railroad Engineering. MR. RESTALL.

A course of four hours per week during the fourth year. It includes the study of the following:

Railroad location, as influenced by topographical features, purpose, grades, pusher grades, length of line curvature, rise and fall. Field work and making of location plans.

Computation, and methods of laying out of simple, compound, reverse and easement curves. Circular and parabolic curves in connection with gradients. Practical curve problems.

Earthwork, slope stakes, cross-sections, burrow pits, methods of computations, tables and diagrams.

Frogs, switches, turnouts, cross-overs, crossing frogs, turnout tables, track, track laying, rail, ballast and drainage.

Yard design, passenger and freight yards, gravity yards,

hump yards, yard accessories, stations, terminals, elimination of grade crossings, methods of construction and making estimates.

Draughting. The course will be supplemented to some extent by draughting and by railroad designing.

Fieldwork. Where necessary to illustrate the principles involved in the course, exercises will be given in the field on Saturday afternoons in the spring.

Preparation. Algebra, geometry, trigonometry, surveying.

If not qualified by having passed the above subjects, a student may be admitted as a special student on approval of the instructor of the course with the consent of the dean.

70. Applied Mechanics.

This course of forty hours comprises a study of general methods and applications of statics, including the determination of stresses in frames; of centre of gravity, moment of inertia and radius of gyration; of kinematics and dynamics including uniform and varying rectilinear and curvilinear motion, centrifugal force, momentum, impact, work, power and kinetic energy.

Equipment

DEPARTMENT OF PHYSICS

There is a large laboratory devoted entirely to Physics, together with a lecture room.

The laboratory is equipped with the most improved devices for instruction in general physical measurements, including the mechanics of solids, liquids, and gases as well as the phenomena of sound, light and heat.

DEPARTMENT OF CHEMISTRY

The Chemical Laboratories have accommodations for more than one hundred and fifty students. The Department comprises three laboratories, a lecture room, a reference library, a combustion room, a balance room, office and supply room. These laboratories are equipped with the most modern apparatus for all lines of chemical work. For analytical work, there is every facility for rapid and accurate work. In addition to this, there is all necessary apparatus for fuel and gas analysis, as well as for a complete course in organic chemistry. The equipment of the laboratories includes vacuum and pressure apparatus balancers, electrolytic circuits, combustion furnaces, gas absorption and explosion apparatus, sampling apparatus and flue thermometers and gas calorimeter. There are also testing machines for oils, viscosimeters, and different sorts of flash point apparatus. A chemical museum is connected with this Department, where specimens for purposes of illustration are kept.

DEPARTMENT OF MECHANICS

Mechanical Laboratories

There is a completely equipped steam engineering laboratory in the new building where students may make practical boiler and fuel tests, as well as study steam engineering practice. In addition to a complete modern power plant used for lighting and heating the buildings, there are several engines used wholly for instruction purposes. The students also have the use of the equipment of our Automobile School, thus giving opportunity to study the most advanced ideas in gasoline engine practice.

Mechanic Arts Laboratories

There are two large laboratories, one for metal work and the other for wood work. These are for the use of those students who wish instruction of this character. The metal working laboratory is now in use in connection with the Automobile School and includes: one large and one small drill press, one large and one small engine lathe, a high-speed lathe, emery wheel, shaper, grinding machine, electric drill and milling machine, together with the necessary equipment for complete machine, and bench work instruction.

The wood working laboratory includes planers, saws, steam boxes and benches, together with all necessary equipment for complete instruction in practical woodworking.

DEPARTMENT OF ELECTRICITY

The laboratory is well equipped with apparatus and possesses a set of instruments for teaching the principles of measurement, including slide-wire and Carey-Foster Bridges, Laboratory Bridge, Portable Testing Set, Potentiometer, apparatus for testing insulation, together with a large assortment of minor Potential and three Constant Current Transformers. Also a $2\frac{1}{2}$ horsepower General Electric Induction motor for 60 cycles and 200 volts.

LIBRARIES

There is in connection with the School a professional library, containing books pertaining to both the practical and theoretical sides of engineering. In addition to this, there also are current periodicals on engineering and scientific subjects.

DEPARTMENT OF PHYSICAL TRAINING

Our new gymnasium with all the latest modern equipment gives ample accommodation for all students.

There is a running track on the grounds adjoining, together with tennis and handball courts; also a large natatorium where swimming is taught by competent instructors.

Additional Information

The School reserves the right to retain for its annual exhibition, and for any other purpose which it may deem necessary, drawings made by students.

Scholarships

As an aid to worthy men who desire an education and are unable to pay in full even our slight charges, a limited number of scholarships have been provided, which will be judiciously distributed by the Educational Committee, to whom application should be made.

Entrance Requirements

Any man of good character, regardless of age, occupation or creed, with adequate general education may be enrolled in the School.

A student may elect any subject, or combination of subjects, which best serves his particular needs. However, to prevent loss of time and expense to the student, he will not be allowed to elect courses which, on account of inadequate preliminary training and experience, he could not pursue with profit. The Dean should be consulted before registration.

Certificates

Upon the satisfactory completion of any of the regular, or special courses, the student is entitled to receive a certificate. No certificates will be given, however, unless the student has successfully performed the prescribed work and passed the necessary examinations.

Suburban Association Members

All tickets held by members of the Cambridge, Chelsea, Everett, Lynn, Malden, Melrose, Newton, Quincy, Salem and Somerville Associations, will be honored for membership in the Boston Association.

Schedule of Rates

Courses I and II (Chemistry and Electrical Engineering).

First year, \$35, including membership, payable as follows:—\$15 upon entering, \$10 November 15, and \$10 January 15.

Second, third and fourth years, \$50 each, including membership, payable as follows:—\$20 upon entering, \$15 November 15, and \$15 January 15.

Courses III, IV and V (Structural, Railroad and Municipal Engineering).

First year \$30, including membership, payable as follows:—\$10 upon entering, \$10 November 15, and \$10 January 15.

Second, third and fourth years, \$50 each, including membership, payable as follows:—\$20 upon entering, \$15 November 15, and \$15 January 15.

Special Note—The following rates are in addition to membership (\$2). In case more than one course is taken, a discount of \$3 for each additional course will be made.

Course	Tuition	Course	Tuition
57 Advanced Structures	\$24.00	8 Machine Drawing	\$11.00
62 Advanced Surveying	24.00	63 Materials of Construction	24.00
38 Alternating Currents I	13.00	1 Mathematics I	13.00
39 Alternating Currents II	18.00	2 Mathematics II	18.00
40 Alternating Currents III	18.00	5 Mechanical Drawing I	9.00
70 Applied Mechanics	18.00	6 Mechanical Drawing II	9.00
9 Architectural Drawing I	9.00	68 Municipal Engineering	24.00
10 Architectural Drawing II	13.00	23 Organic Chemistry Prob.	50.00
53 Bridge Design	24.00	16 Physics I	18.00
43 Central and Substations	24.00	17 Physics II	13.00
35 Direct Current Practice	24.00	15 Plan Reading and Estimating	13.00
29 Electricity Ia	13.00	44 Power Transmission	13.00
30 Electricity Ib	13.00	20 Qualitative Analysis	32.00
31 Electricity IIa	13.00	69 Railroad Engineering	28.00
32 Electricity IIb	18.00	58 Reinforced Concrete	24.00
33 Electricity III	18.00	67 Sanitary Engineering	24.00
34 Electricity IV	18.00	60 Stereotomy	18.00
45 Electricity V	24.00	56 Strength of Materials	24.00
46 Electric Railways	20.00	52 Structural Design	24.00
11 Freehand Drawing I	8.00	51 Structural Drawing	24.00
64 Foundations	13.00	54 Structural Mechanics	24.00
12 Freehand Drawing II	8.00	61 Surveying and Plotting	24.00
22 Gravimetric Analysis	25.00	36 Switchboards and Apparatus	18.00
47 Heat Engineering	18.00	24 Technical Analysis	25.00
65 Highways	18.00	41 Technical Elect. Measurements I	18.00
66 Hydraulics	18.00	42 Technical Elect. Measurements II	18.00
48 Hydraulic Motors	18.00	25 Theoretical Chemistry I	18.00
14 Illustrating and Cartooning	25.50	26 Theoretical Chemistry II	18.00
13 Industrial Design	8.00	55 Theory of Structures	24.00
27 Industrial Chemistry	18.00	59 Topographical Drawing	18.00
18, 19 Inorganic Chemistry	24.00	3 Trigonometry	13.00
28 Journals		21 Volumetric Analysis	16.00
4 Logarithms and Slide Rule	8.00	37 Wiring and Nat. Code	18.00
7 Lettering	6.00		

The tuition for all courses is payable in advance unless stated to the contrary, in which case times of payment are indicated. Numbers preceding courses refer to description of courses, pages 14 to 38.

Students who discontinue a course, but who have attended four or more recitations in the subject, will be required to pay a term's tuition.

No student is permitted to transfer from one course to another without consulting the Dean beforehand and receiving a transfer order which must be presented at the main office for the proper ticket.

Other Courses in Evening Schools

Agency	French I
Algebra, Elementary	French II
Algebra, Advanced	French III
Arithmetic, Commercial	French IV
Arithmetic, General	Garment Drafting
Auditing, Elements of	Geometry, Plane
Auditing, Advanced	Geometry, Solid
Automobile Courses:	German I
Chauffeurs' and Operators' Lecture	German II
Chauffeurs' and Operators' Laboratory	German III
Chauffeurs' and Operators' Road	German IV
Garage Course	Greek
Machine Shop Repair	History, American
Banking	History, Ancient
Bankruptcy	Investments
Bills and Notes	Italian
Bookkeeping, Elementary	Latin I
Bookkeeping, Advanced	Latin II
Buying	Latin III
Civil Service	Latin IV
Commercial Credits	Law, Commercial
Commercial Resources	Law, Special (in Law School)
Constitutional Law	Massachusetts Practice
Contracts	Mathematics, Practical
Conveyancing	Office Organization and Administration
Corporations	Partnership
Corporation Finance	Penmanship
Corporate Reorganizations	Physical Geography
Cost Accounting, Elements of	Physics
Cost Accounting, Advanced	Physiology
Criminal Law	Pleading
Crises, Commercial	Property I
Economics, Applied	Property II
Economics, Principles of	Property III
Elementary Science	Public Accounting
English I	Publicity
English II	Sales
English III	Selling
English IV	Shorthand I
English, Business	Shorthand II
Equity I	Show Card Writing
Equity II	Spanish
Evidence	Spelling
Factory Organization and Administration	System Building, Elements of
Finance and Bond Salesmanship	System Building, Advanced
Financial Statistics	Teachers' Industrial Course
Foreign Exchange	Torts
	Typewriting
	Window Dressing

Preparatory School Subjects scheduled both winter and summer terms

Courses in Day Schools

Alternating Current	Geology, Structural
Alternating Current Laboratory	Geometry, Plane
Alternating Current Machinery	Geometry, Solid
Algebra I	Geometry, Analytical
Algebra II	Geometry, Descriptive
Applied Mechanics I	German I
Applied Mechanics II	German II
Applied Mechanics III	German III
Applied Mechanics, Laboratory	German IV
Arithmetic	Greek
Arithmetic, Commercial	High Temperature Measurements
Automobile Garage Course	Highway Engineering
Automobile Machine Shop Course	Heat Engineering: Thermodynamics
Automobile, Operator's Laboratory	and Boilers
Course	History, American
Automobile, Operator's Lecture	History, Ancient
Course	Hydraulics, Theoretical
Automobile, Operator's Road	Hydraulic Motors
Course	Hydraulic and Sanitary Engineering
Bookkeeping, Advanced	Illumination and Photometry
Bookkeeping, Elementary	Industrial Chemistry
Calculus	Industrial Design
Central Stations	Intercommunicating Telephones
Chemistry I	Latin I
Chemistry II	Latin II
Chemistry I, Engineering	Latin III
Chemistry II, Engineering	Latin IV
Concrete Construction	Law, Commercial
Design, Machine	Lettering
Design, Power Plant	Lithology
Design, Structural	Materials
Drawing, Boiler	Mathematics I, Engineering
Drawing, Freehand	Mathematics II, Engineering
Drawing, Machine	Machine Design
Drawing, Mechanical	Metal Work
Drawing, Topographical	Metallurgy of Iron
Dynamics of Machines	Penmanship
Elementary Electrical Laboratory	Physics I
Electrical Engineering Laboratory	Physics II
Elementary Science	Physics, Laboratory
Electric Railways	Public Speaking
Electricity I	Qualitative Analysis
Electricity II	Quantitative Analysis
Electricity III	Railroad Engineering
Electric Light and Transmission of	Shorthand I
Power	Shorthand II
English I	Spanish
English II	Spelling
English III	Stereotomy
English IV	Studies in Electrical Construction
English, Business	Surveying
Forging, Chipping and Filing	Surveying, Advanced
Foundations	Trigonometry
Foundry Practice	Typewriting
French I	Theory of Structures
French II	Technical Electrical Measurements
French III	Valve Gears
French IV	Wiring and National Code
Geology, Dynamical	Wood Working and Pattern Work

Department of Education

BOSTON YOUNG MEN'S CHRISTIAN ASSOCIATION

Huntington School

Day and Evening Sessions

A high-grade School consisting of a Grammar Department (6th, 7th and 8th grades) a Preparatory Department fitting for the Colleges, Medical and Dental schools, Massachusetts Institute of Technology, Annapolis, West Point, Lowell School for Industrial Foremen, Law Schools and the classified Civil Service and a Technical Department fitting for positions along engineering lines.

School of Business

Day and Evening Sessions

Offers all of the courses of the regular Business School program, and additional cultural courses preparing for business and admission to our School of Commerce and Finance.

Co-operative Engineering School

Day Sessions

Four years' courses of college grade in Chemistry, Mechanical and Civil Engineering, etc., in cooperation with business firms. Students earn while learning. Open to High School graduates.

School of Commerce and Finance

Evening Sessions

Established 1907; incorporated 1911. Offers a two years' course in preparation for the Certified Public Accountants' examinations. Provides a three years' course in the science of Business administration. Grants degrees of Bachelor of Commercial Science and Master of Commercial Science.

Evening Law School

Evening Sessions Only

Established in 1898; incorporated in 1904. Provides a four years' course in preparation for the Bar and grants the Degree of Bachelor of Laws.

Polytechnic School

Day and Evening Sessions

A School of many departments, training students in Applied Science. Much of this work is of college grade.

Automobile School

Day and Evening Sessions

Deals with the construction, care, and operation of all types of gasoline vehicles; a large staff of teachers; ample equipment and garage. NEW BUILDING.

For further information concerning any of the above schools or departments, address the Director of Education,

FRANK PALMER SPEARE,

312 Huntington Avenue, Boston, Mass.

Other Departments

RECREATION AND HEALTH

ALBERT E. GARLAND, M.D., B.P.E., Director

The physical work is under the best supervision, and the aim is to better fit men for their life work by increasing their efficiency through exercise. We offer: Well equipped gymnasiums, Recreative, Hygienic and Educational Gymnastics. Numerous classes the year round. Shower, steam and electric baths. Best instruction. Medical direction. Handball courts, Basket Ball, Baseball and Athletics.

RELIGIOUS WORK

EDWIN W. PEIRCE, Secretary

In order that a young man may secure a well-balanced development and attain the true foundation for successful life work, the Association advises each member in planning his schedule to enter into one or more of the following activities:—

Bible Study, Training for Christian Service, Sunday Meetings of Men, Personal Service Groups and The Twenty-Four-Hour-A-Day-Club.

(Ask for Bible Institute Catalog and other printed matter.)

SOCIAL WORK

DAVID M. CLAGHORN, Secretary

The attention of members is called to the many opportunities in the Association for social service, and the following social features.

Newly Equipped Game Rooms	The Popular Novel Club
The Association Congress	The Land and Water Club
Camera Club	Glee Club

Recreation Headquarters at Riverside

Popular Social Evenings and Entertainments

DEPARTMENT OF EMPLOYMENT

FREDERICK W. ROBINSON, Secretary

The Employment Department is in actual practice, a clearing house for young men seeking work, and employers who wish to engage reliable help. From 5000 to 8000 men apply every year. Members of the Association are given 25 per cent discount from the legal rates and special effort is made to notify them when good positions are open.

BOYS' DEPARTMENT

DON S. GATES, A.B., City Secretary

The physical, social, employment and religious advantages offered to boys from twelve to eighteen years, are similar to those offered to men as stated above. Members of the school may use the boys' Game and Social Rooms and take part in special activities, such as Entertainments, Minstrel Shows, Debates, Bible Classes, Clubs, etc.

Reserve *Co. 11*

THE EVENING POLYTECHNIC SCHOOL

CATALOG
1914-1915



EVENING COLLEGE COURSES

PUBLISHED BY THE
EDUCATIONAL DEPARTMENT
OF THE
BOSTON YOUNG MEN'S CHRISTIAN ASSOCIATION
316 HUNTINGTON AVENUE
BOSTON, MASS.

DEPARTMENT OF EDUCATION

BOSTON YOUNG MEN'S CHRISTIAN ASSOCIATION

EVENING LAW SCHOOL

Evening Sessions Only

Established in 1898; incorporated in 1904. Provides a four years' course in preparation for the Bar and grants the Degree of Bachelor of Laws.

SCHOOL OF BUSINESS

Day and Evening Sessions

Offers all of the courses of the regular Business School program, and additional cultural courses, preparing for business and admission to our School of Commerce and Finance.

SCHOOL OF COMMERCE AND FINANCE

Evening Sessions

Established 1907; incorporated 1911. Offers the following four-year courses leading to the degree of B.C.S. (Bachelor of Commercial Science): Banking, Business Administration, Finance and Bond Salesmanship, and Professional Accountancy. Anyone passing the examination for advanced standing, is enabled to complete any one of the four regular courses and secure the degree in three years. Special courses in addition to regular courses.

PREPARATORY SCHOOL

Evening Sessions

A school of high school grade to prepare students for Colleges, Scientific Schools, West Point, Annapolis, Lowell School for Industrial Foremen, and the classified Civil Service.

HUNTINGTON SCHOOL

Day Sessions

A high-grade school, consisting of a Grammar Department (5th, 6th, 7th and 8th grades), a Preparatory Department, fitting for the Colleges, Medical and Dental Schools, Massachusetts Institute of Technology, Annapolis, West Point, Lowell School for Industrial Foremen, Law Schools and the classified Civil Service, and a Technical Department, fitting for positions along engineering lines.

CO-OPERATIVE ENGINEERING SCHOOL

Day Sessions

Four years' courses of college grade in Chemistry, Mechanical and Civil Engineering, etc., in co-operation with business firms. Students earn while learning. Open to High School graduates.

AUTOMOBILE SCHOOL

Day and Evening Sessions

Deals with the construction, care, repair and operation of all types of gasoline vehicles; a large staff of teachers; ample equipment and garage.

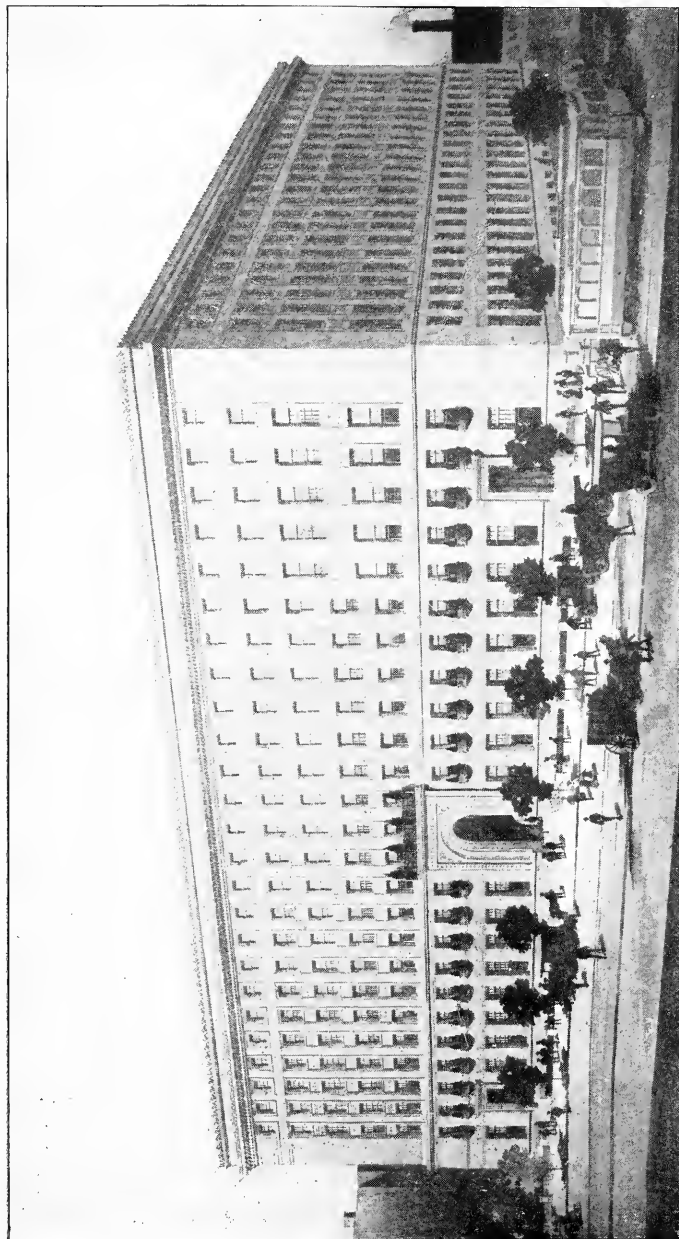
For further information concerning any of the above schools, or departments, address the Director of Education,

FRANK PALMER SPEARE,
316 Huntington Avenue,
Boston, Mass.

CATALOG
OF THE
EVENING POLYTECHNIC
SCHOOL
1914-1915



PUBLISHED BY THE
EDUCATIONAL DEPARTMENT
OF THE
BOSTON YOUNG MEN'S CHRISTIAN ASSOCIATION



OUR NEW HOME

This is a picture of the new Association Building which was finished in the Fall of 1913. It contains, among other features, school accommodations of the very best, a fine gymnasium, bowling alleys, swimming pool, cafe, dormitories, shops and laboratories, library and reading room, camera club rooms, social and recreative rooms and auditorium.

Calendar

1914-1915

Sept. 16-19	Registration
Sept. 21	Opening of school
Oct. 12	Columbus Day, Holiday
Nov. 26	Thanksgiving Day, Holiday
Dec. 21-28	Christmas Recess
Feb. 22	Washington's Birthday, Holiday
April 10	Close of school

Officers of Administration

General Administrative Officers

ARTHUR S. JOHNSON, *President*

JACOB P. BATES, *Vice-President*

HAROLD PEABODY, *Recording Secretary*

FRANCIS B. SEARS, *Treasurer*

GEORGE W. MEHAFFEY, *General Secretary*

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WILLIAM E. MURDOCK

ALBERT H. CURTIS

MORGAN L. COOLEY

GEORGE H. MARTIN

Educational Administrative Officers

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GALEN D. LIGHT, *Asst. Director of Educ. and Bursar*

H. W. GEROMANOS, *Supt. of Evening School System*

IRA A. FLINNER, *Supt. of Day School System*

CHARLES B. GRAY, *Secretary*

ERNEST H. BROOKE, *Registrar*

F. L. DAWSON, *Field Secretary*

Officers of Instruction

THOMAS E. PENARD, S.B., *Mass. Inst. Tech.*
DEAN

WALTER A. BALDWIN, A.B.
Physics

JAMES BROUGH
Freehand Drawing and Industrial Design

LOREN N. DOWNS, JR., S.B.
Electrical Engineering

CARL S. ELL, S.B., M.S.
Structural Engineering

A. L. GARDNER, S.B.
Mechanical Engineering

LESTER GUSTIN, S.B.
Structural Engineering

FRED G. HARTWELL
Electrical Practice and Construction

JOHN W. HOWARD, S.B.
Surveying

EDWARD MUELLER, A.B., PH.D.
Chemistry

W. W. NORTON
Surveying

THOMAS E. PENARD, S.B.
Mathematics

M. F. PINKHAM
Mathematics

CHARLES H. RESTALL, S.B.
Railroad Engineering

R. E. SMITH
Electrical Practice and Construction

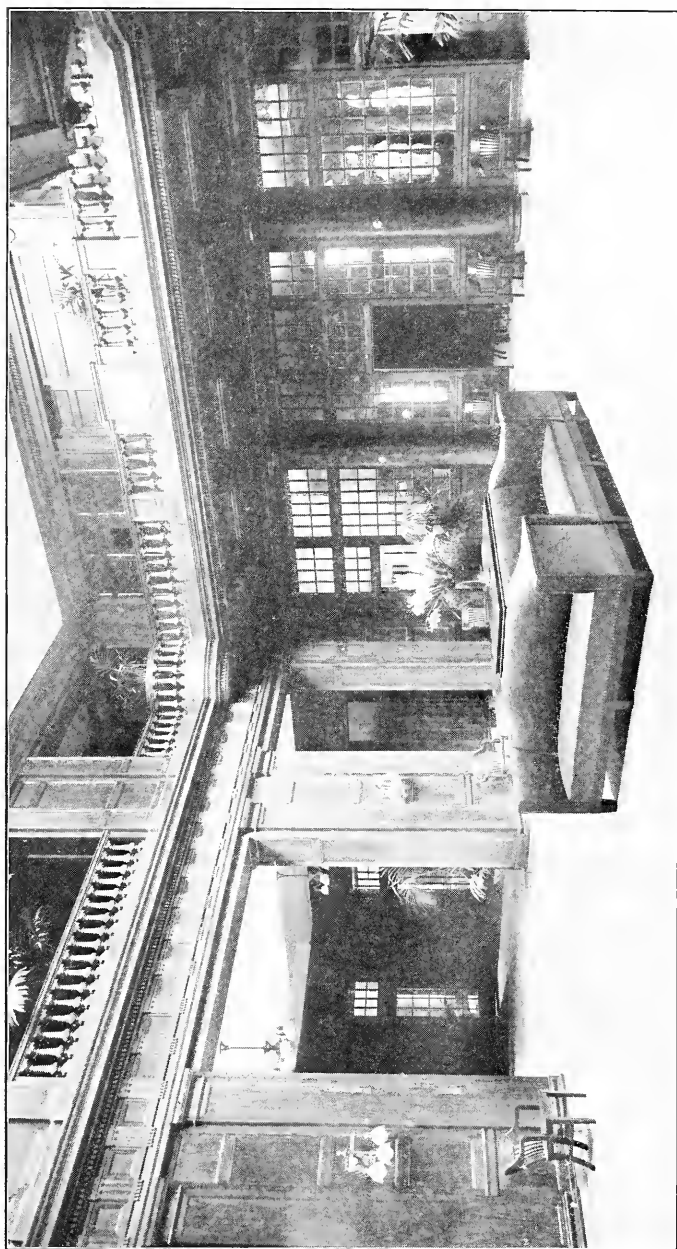
W. LINCOLN SMITH, S.B.
Electrical Engineering

ELLWOOD B. SPEAR, A.B., PH.D.
Chemistry

SAMUEL A. S. STRAHAN
Chemistry

GEORGE A. TRUELSON
Architecture

W. F. WILLMANN
Mechanical Drawing



MAIN LOBBY

Foreword

A great many men employed in engineering and other work of a technical nature, feel the need of special instruction but cannot afford to take the time to attend the regular technical day schools. To such men the Evening Polytechnic School offers a large number of special courses, and to those who are willing to give three evenings per week for a period of from three to five years the school offers several regular courses of very high grade which compare favorably with similar courses given in the good technical schools of the country.

The courses offered in this school are with a very few exceptions of college grade, so that the graduates will find themselves trained to meet the problems arising in engineering practice. They are sufficiently well equipped to hold important positions, and acquit themselves creditably.

On the following pages will be found a complete description of the regular and special courses, requirements for admission, rates of tuition and other general information.

Courses of Study

Regular Courses

- I.—Chemistry and Chemical Engineering
- II.—Electrical Engineering
- III.—Structural Engineering
- IV.—Railroad Engineering
- V.—Municipal Engineering

Schedule of Subjects

No.	Course	No.	Weeks	Evenings	Time
1	Mathematics I	28	Mon., Fri.	Sect. A	7.00-7.45
				Sect. B & C	7.45-8.30
2	Mathematics II	28	Mon., Fri.	Sect. A	7.00-7.45
				Sect. B	8.30-9.30
3	Mechanical Drawing I	6	Wed.		7.00-9.30
4	Mechanical Drawing II	28	Wed.		7.00-9.30
5	Machine Drawing	28	Wed., Fri.		7.00-9.30
6	Architectural Drawing I	28	Mon., Fri.		7.00-9.00
7	Architectural Drawing II	28	Mon., Fri.		7.00-9.00
8	Architectural Drawing III	28	Mon., Fri.		7.00-9.00
9	Freehand Drawing I	28	Tues., Sat.		7.30-9.30
10	Freehand Drawing II	28	Tues., Sat.		7.30-9.30
11	Industrial Design	28	Tues., Sat.		7.30-9.30
12	Life Class	28	Tues., Sat.		7.30-9.30
13	Physics	28	Mon., Fri.		8.30-9.30
14	Inorganic Chemistry Lect.	28	Mon., Fri.		7.00-7.45
15	Inorganic Chemistry Lab.	28	Wed.		7.00-9.30
16	Qualitative Analysis	28	Mon., Tues.		A
17	Volumetric Analysis	14	Mon., Tues.		A
18	Gravimetric Analysis	14	Mon., Tues., Wed.		A
19	Organic Chemistry	28	Mon., Tues., Wed.		A
20	Technical Analysis	28	Mon.		A
21	Theoretical Chemistry I	28	Wed.		8.30-9.30
22	Theoretical Chemistry II	28	Fri.		7.00-7.45
23	Industrial Chemistry	28	Mon.		7.45-8.30
24	Electricity Ia	14	Mon., Fri.		7.00-7.45
25	Electricity Ib	14	Mon., Fri.		7.00-7.45
26	Electricity IIa	14	Wed.		7.00-9.30
27	Electricity IIb	14	Wed.		7.00-9.30
28	Electricity III	28	Fri.		7.45-8.30
29	Electricity IV	22	Wed.		7.45-9.30
30	Direct Current Practice	28	Mon., Fri.		8.30-9.30
31	Switchboards & Apparatus	20	Mon.		7.45-8.30

No.	Course	No. Weeks	Evenings	Time
32	Wiring and Nat. Code	10	Mon.	7.45-8.30
33	Alternating Currents I	20	Mon., Thurs.	7.00-8.30
34	Alternating Currents II	28	Mon., Tues., Thurs.	B
35	Alternating Currents III	8	Tues.	B
36	Technical Elect. Measurements I	20	Tues.	7.00-9.30
37	Technical Elect. Measurements II	20	Tues.	7.00-9.30
38	Central and Sub-Stations	20	Tues.	7.00-7.45
39	Power Transmission	10	Fri.	7.45-9.30
40	Electric Railways	18	Fri.	7.45-9.30
41	Heat Engineering	28	Mon.	8.30-9.30
42	Hydraulic Motors	28	Thurs.	8.30-9.30
43	Colloquium			
44	Thesis	28	Mon.	7.45-9.30
45	Elementary Mechanics	28	Mon., Fri.	8.30-9.30
46	Structural Drawing	28	Wed.	7.00-9.30
47	Structural Design	28	Wed.	7.00-9.30
48	Bridge Design	28	Wed.	7.00-9.30
49	Structural Mechanics	28	Mon., Fri.	7.00-8.30
50	Theory of Structures	28	Mon., Fri.	7.00-8.15
51	Strength of Materials	28	Mon., Fri.	8.15-9.30
52	Advanced Structures	28	Mon., Fri.	7.00-8.30
53	Reinforced Concrete	28	Mon., Fri.	8.30-9.30
54	Topographical Drawing	20	Tues.	7.00-9.30
55	Stereotomy	8	Mon., Fri.	8.30-9.30
56	Surveying and Plotting	28	Mon., Fri.	7.00-8.30
57	Advanced Surveying	20	Mon., Fri.	8.30-9.30
58	Materials of Construction	28	Wed.	7.00-8.30
59	Foundations	8	Thurs.	7.00-8.30
60	Highways	8	Tues.	7.00-9.30
61	Hydraulics	28	Thurs.	8.30-9.30
62	Sanitary Engineering	28	Mon., Thurs.	7.00-8.30
63	Municipal Eng. Problems	28	Thurs.	7.00-8.30
64	Railroad Engineering	28	Mon., Fri.	7.00-8.30
65	Applied Mechanics	20	Mon., Fri.	7.00-8.30

A. For hours of instruction see Schedule for Chemistry.

B. For hours of instruction see Schedule for Electrical Engineering.

NOTE: For Prices see Schedule of rates.

Schedules of Courses

I. CHEMISTRY AND CHEMICAL ENGINEERING

First Year

Period	Monday	Wednesday	Friday
7.00-7.45	Inorg. Chem. Lect. (14)	Inorg. Chem. Lab. (15)	Inorg. Chem. Lect. (14)
7.45-8.30	Math. I (1)	"	Math. I (1)
8.30-9.30	Physics (13)	"	Physics (13)

Second Year

Period	Monday	Tuesday	Friday
7.00-7.45	Math. II (2)	Qual. Anal. Lect. (16)	Math. II (2)
7.45-8.30	Qual. Anal. Lab. (16)	Qual. Anal. Lab. (16)	Mech. Drawing
8.30-9.30	"	"	"

Third Year

Period	Monday	Tuesday	Wednesday
7.00-7.45	Anal. Lab. (17) or (18)	Anal. Lab. (17) or (18)	German I
7.45-8.30	"	"	Anal. Lect. (17) or (18)
8.30-9.30	"	"	

Fourth Year

Period	Monday	Tuesday	Wednesday
7.00-7.45	Org. Chem. Lab. (19)	Org. Chem. Lab. (19)	Org. Chem. Lect. (19)
7.45-8.30	"	"	German II
8.30-9.30	"	"	Theo. Chem. I (21)

Fifth Year. For Chemical Engineering Students only

Period	Monday	Wednesday	Friday
7.00-7.45	Tech. Anal. Lect. (20)	Elect. IV (29)	Theo. Chem. II (22)
7.45-8.30	Indust. Chem. (23)	"	Elect. III (28)
8.30-9.30	Heat Eng. (41)	"	

Note: Numbers in parentheses refer to description of courses, pages 16 to 41.

II. ELECTRICAL ENGINEERING

First Year

Period	Monday	Wednesday*	Friday
7.00-7.45	Elect. Ia (24) Elect. Ib (25)	Elect. IIa (26) Elect. IIb (27)	Elect. Ia (24) Elect. Ib (25)
7.45-8.30	Math. I (1)	"	Math. I (1)
8.30-9.30	Elem. Mechanics (45)	"	Elem. Mechanics (45)

Second Year

Period	Monday	Wednesday	Friday
7.00-7.45	Math. II (2)	Mech. Dwg. I (3) Elect. IV (29)	Math. II (2)
7.45-8.30	Wiring, Nat. Code (32) Switchboards (31)	"	Elect. III (28)
8.30-9.30	D. C. Practice (30)	"	D. C. Practice (30)

Third Year

Period	Monday	Tuesday	Thursday
7.00-8.30	Alt. Cur. I (33)	Tech. Elect. Meas. I & II (36, 37)	Alt. Cur. I (33)
8.30-9.30	Alt. Cur. IIa (34) Heat Eng. (41)	Alt. Cur. IIIa (35) "	Alt. Cur. IIa (34) Hydr. Motors (42)

Fourth Year

Period	Monday	Tuesday	Friday
7.00-7.45	Inorg. Chem. Lect. (14)	Cent. & Sub-sta. (38) Alt. Cur. IIIb	Inorg. Chem. Lect. (14)
7.45-9.30	Thesis (44)	Alt. Cur. IIb (34) Alt. Cur. IIIb (35)	El. Railways (40) Power Transm. (39)

*If the class is very large a second section will meet on Thursday.

Note: Numbers in parentheses refer to descriptions of courses, pages 16 to 41.

III. STRUCTURAL ENGINEERING

First Year

Period	Monday	Wednesday	Friday
7.00-7.45	Math. I (1)	Mech. Drawing II (4)	Math. I (1)
7.45-8.30		"	
8.30-9.30	Elem. Mechanics (45)	"	Elem. Mechanics (45)

Second Year

Period	Monday	Wednesday	Friday
7.00-8.30	Struct. Mech. (49)	Struct. Drawing (46)	Struct. Mech. (49)
8.30-9.30	Math. II (2)	"	Math. II (2)

Third Year

Period	Monday	Wednesday	Friday
7.00-8.15	Theo. Struct. (50)	Struct. Design (47)	Theo. Struct. (50)
8.15-9.30	Str. of Materials (51)	"	Str. of Materials (51)

Fourth Year to be omitted during 1914-15

Period	Monday	Wednesday	Friday
7.00-8.30	Adv. Struct. (52)	Bridge Design (48)	Adv. Struct. (52)
8.30-9.30	Concrete (53)	"	Concrete (53)

Note: Numbers in parentheses refer to descriptions of courses, pages 16 to 41.

IV. RAILROAD ENGINEERING

First Year

Period	Monday	Wednesday	Friday
7.00-7.45	Math. I (1)	Mech. Dwg. II (4)	Math. I (1)
7.45-8.30		“	
8.30-9.30	Elem. Mechanics (45)	“	Elem. Mechanics (45)

Second Year

Period	Monday	Tuesday	Friday
7.00-8.30	Survey & Plot. (56)	Topo. Dwg. (54) Highways (60)	Survey & Plot.
8.30-9.30	Math. II (2)	“	Math. II (2)

Third Year. To be omitted during 1914-15

Period	Monday	Wednesday	Friday
7.00-8.30	Railroad Eng. (64)	Materials of Const. (58)	Railroad Eng. (64)
8.30-9.30	Adv. Survey. (57)		Adv. Survey. (57)
8.30-9.30	Stereotomy (55)		Stereotomy (55)

Note: Numbers in parentheses refer to description of courses, pages 16 to 41.

V. MUNICIPAL ENGINEERING

First Year

Period	Monday	Wednesday	Friday
7.00-7.45	Math. I (1)	Mech. Dwg. II (4)	Math. I (1)
7.45-8.30		"	
8.30-9.30	Elem. Mechanics (45)	"	Elem. Mechanics (45)

Second Year

Period	Monday	Tuesday	Friday
7.00-8.30	Survey & Plot. (56)	Topo. Dwg. (54)	Survey & Plot. (56)
		Highways (60)	
8.30-9.30	Math. II (2)	"	Math. II (2)

Third Year. To be omitted during 1914-15

Period	Monday	Wednesday	Friday
7.00-8.30	Applied Mech. (65)	Mater. of Const. (58)	Applied Mech. (65)
	Stereotomy (55)		Stereotomy (55)
8.30-9.30	Concrete (53)		Concrete (53)

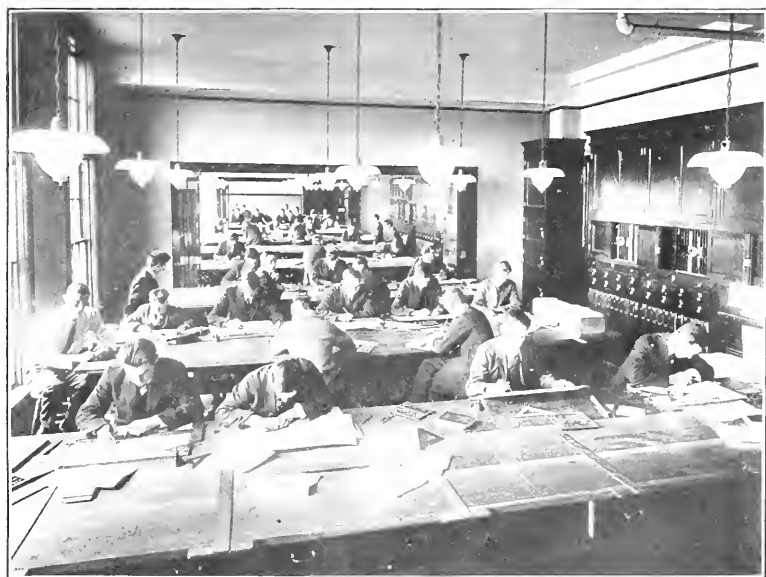
Fourth Year. To be omitted during 1914-15

Period	Monday	Wednesday	Thursday
7.00-8.30	Sanitary Eng. (65)	Municip. Eng. Prob. (63)	Sanitary Eng. (65)
			Foundations (59)
8.30-9.30	Heat Eng. (41)	Pract. Elect.	Hydraulics (61)

Note: Numbers in parentheses refer to descriptions of courses, pages 16 to 41.



REFERENCE LIBRARY



DRAFTING ROOM

DEPARTMENT OF MATHEMATICS

DIRECTOR: THOMAS E. PENARD, S. B.

INSTRUCTOR: MR. M. F. PINKHAM.

The importance of mathematics as a means of mental discipline, and as a necessary basis for those intending to pursue engineering as a profession, cannot be overestimated.

Students taking the regular courses in Chemistry and Engineering are given two years instruction in applied mathematics, as outlined in Mathematics I and II. Special attention is called to these two courses in practical mathematics, which are intended to cover the field in so far as mathematics is ordinarily employed in the usual engineering computations.

Courses in advanced applied mathematics will be given provided a sufficient number of men apply to form a class.

1. **Mathematics I.** MR. PENARD AND MR. PINKHAM.

Preparation: Arithmetic.

This course, of two periods per week during the first year, is designed primarily for students taking the regular engineering courses; it is hoped, however, that it will be found adapted to the needs of others who wish to obtain a practical knowledge of elementary mathematics. The student is assumed to be thoroughly familiar with the fundamental operations of arithmetic.

Algebra, including definitions and notation, fundamental operations, factoring, fractions, simple equations, powers and roots, ratio and proportion, variation, with applications to problems chosen from electricity and mechanics, formulas.

Logarithms, the use of slide rules, discussion of precision and rules for significant figures.

Geometry, including useful theorems relating to plane figures, without proofs, measurements of triangle, polygons, circle, polyhedrons, cylinder, cone and sphere.

2. **Mathematics II.** MR. PENARD AND MR. PINKHAM.

Preparation: Mathematics I, (1), or equivalent.

This course of two periods per week during the second year, like Mathematics I, of which it is a continuation, is designed primarily for students taking the regular engineering courses,

but may be taken to advantage by those regularly employed in engineering work who wish to obtain a more thorough grasp of applied mathematics.

Trigonometry including circular measure, co-ordinates, trigonometric ratios, formulas, law of sines, law of cosines, solution of right and oblique triangles, applications to problems in Physics and Engineering.

Plotting of functions, interpolation, the straight line, curves represented by various equations, graphic solution of equations, determination of laws from the data of experiments, simplification of formulas.

Rate of increase, differentiation, determination of maxima and minima by differentiation, integration, definite integrals, determination of mean value, area and volume by integration, centre of gravity, moment of inertia, partial differentiation.

Analytic Geometry and Calculus.

See Mathematics II

DEPARTMENT OF DRAWING

INSTRUCTORS: MR. JAMES BROUGH, MR. GEORGE A. TRUELSON, MR. W. F. WILLMANN.

The courses in Mechanical and Architectural drawing, as outlined, afford the essentials of drafting for those contemplating office work and are equally valuable and necessary to those working in the allied trades.

The art courses are varied and the work is thorough and complete, and of a high order. Great care is taken to develop the student along the line of his natural inclinations, and, so far as possible, to have the work of the school bear directly upon his daily employment and other courses attended.

3. Mechanical Drawing I. MR. WILLMANN.

This course is given during the first six weeks of the second year and is especially designed for students taking the electrical engineering course. Instruction will be given in the use of drawing instruments and the fundamental rules for executing engineering drawings.

4. Mechanical Drawing II. MR. WILLMANN.

This course consists of work in the drawing room, occupying one evening a week throughout the entire first year. The drawing is of an elementary character, beginning with instruction in the use of instruments and the fundamental rules for executing engineering drawings. In conjunction with the drawing, the elementary principles of descriptive geometry and projections are studied, and the student prepares a number of plates illustrating the reproduction of objects in the shape of working drawings.

5. Machine Drawing. MR. WILLMANN.

The aim of the course is to teach the proper way of making the necessary dimensioned drawings for use in practice. The instruction includes: (a) The making of sketches of the parts of a machine from measurements; (b) the detail scale drawing from the sketches and a tracing; (c) an assembly drawing of the machine.

6. Architectural Drawing I. MR. TRUELSON.

An elementary course, including the fundamental principles underlying all kinds of mechanical and architectural drawing: geometrical problems; orthographic and isometric projections and the orders of architecture.

In connection with this course the instructor will outline a course of reading in architectural history.

7. Architectural Drawing II. MR. TRUELSON.

The orders of Architecture. Practical architecture and details of construction. In this course the student is taught the component parts of buildings. Typical details of construction are drawn to a large scale and in isometric projection.

8. Architectural Drawing III. MR. TRUELSON.

This course covers the making of complete plans, elevations and working drawings of some elementary problem.

Special Students

Students desiring special work in Architectural Drawing, not outlined above, should consult with the instructor.

9 and 10. Freehand Drawing. MR. BROUGH.

Considering the great importance of the study of freehand drawing to all who are engaged in, or anticipate being engaged in any industrial art, artistic trade, or profession, we offer a very complete course in this line, and call attention to the splendid advantages provided.

The work is adapted to the requirements of each individual student, so far as is practical and consistent with a thorough training in freehand drawing. There are two classes in both freehand drawing and industrial design.

9. Class I. The work of this class is intended to meet the wants of those students who have no previous knowledge of freehand drawing and is recommended to all students who intend to become craftsmen, designers, architects, or artists, and also to others who may wish to take up the study as an accomplishment. The work will consist of drawing from typical models, by which students learn a sense of proportion and the principles of perspective; groups of still life for the study of composition and color; also drawing of historic ornament, and details of the human figure from the cast, by which students are taught to observe form, and the principles of light and shade.

10. Class II. The course of study in this class is of a more advanced nature than that of Class I, and in addition to the more complicated forms of ornament, the full-length human figure from the antique is added, also rendering in pen and ink and pencil, advanced shading in charcoal, painting groups of still life in monochrome and polychrome, in oil and water colors.

These courses will not be given unless a sufficient number of men apply for them.

11. Industrial Design and Interior Decoration. MR. BROUGH.

The courses in industrial design and interior decoration are specially helpful to those students who are already engaged in, or anticipate being engaged in such arts and crafts, as wood and stone carving, wrought and bent-iron work, brass and copper work, stained glass, furniture and drapery, interior decoration, book covers, wall paper, fabrics and other allied industrial arts, including lettering and commercial designing for advertising purposes. No limitation is placed upon the student who shows ability to take up the work prescribed for the class he wishes to

enter, and students who so desire may spend part of their time in the freehand class and part in the industrial design and interior decoration class, without extra charge. The instructor is a certified art master and one of the leaders of the profession. Students in industrial design are recommended to take architecture.

Class I. The studies in this class include the work of the freehand drawing in Class I, with the addition of special studies given for the purpose of design, such as a systematic study of the various styles of historic ornament, studies of animal and plant form, and the elementary principles of design.

Class II. Students who have an elementary knowledge of drawing and design are considered eligible for this class and are taught the more advanced principles of composition, form and color in design, also rendering the same in various mediums, including charcoal, pencil, pen and ink, water and oil colors.

Our special library can be consulted by the students in these classes.

These courses will not be given unless a sufficient number of men apply for them.

12. Life Class. MR. BROUGH.

At the repeated request of a number of advanced students we offer this class which will give an exceptional opportunity to students who wish to pursue their studies for the purpose of acquiring a more perfect knowledge of the figure, and will be of great advantage to those who wish to become more proficient in this branch of art. At the present time the use of the figure is introduced into nearly every form of art work, not only in a purely artistic sense, but also in many forms of commercial work, and to be able to draw the figure well is a great achievement to the artist and designer.

This course will not be given unless a sufficient number of men apply for it.

Structural Drawing. See Dept. of Structural Engineering.
Topographical Drawing. " " " "

DEPARTMENT OF PHYSICS

INSTRUCTOR: MR. WALTER A. BALDWIN.

13. Physics. MR. BALDWIN.

This course appeals strongly to men engaged in technical work. Instruction is given in the practical application of

physical laws. Problems are given throughout the year to test the pupil's knowledge of these laws. A fully equipped laboratory, accommodating thirty students working at one time, makes it possible to give the best of instruction. The exercises will be selected from the following subjects:

Mechanics

Density and specific gravity, simple machines, parallelogram of forces, friction, pendulum, strength of materials, laws of elasticity, liquids and gases.

Heat

Thermometry-coefficients, laws of expansion, specific heat, latent heat.

Light

Reflection, refraction.

Sound

Velocity, wave length, pitch.

Electricity

Magnetism, cells, electromotive force, resistance.

This course is especially fitted for those who wish to take the College Entrance examinations, and for such students a series of additional exercises is planned covering the work very thoroughly.

DEPARTMENT OF CHEMISTRY AND CHEMICAL ENGINEERING

DIRECTOR: ELLWOOD B. SPEAR, A.B., PH.D.

INSTRUCTORS: EDWARD MUELLER, S.B., PH.D. AND ASSISTANTS.

The wonderful advance in the application of science to the arts during the past few years has caused a great demand for technically trained men. Nearly every large manufacturing concern now employs chemists regularly, or else has experts whom it can consult at short notice. The scientific and technical schools are each year sending out large classes of young men, especially trained to meet this demand. For a young man to acquire this education requires four years at a scientific, or technical school, in addition to the four years necessary for preparation at the secondary school, and an outlay of from two to three thousand dollars. These necessary expenditures of

time and money are such that many young men, who are mentally capable of taking such courses, are obliged to give up their ambitions and fill inferior positions.

Formerly the practical knowledge which young men acquired by contact with their work was sufficient, but today the degree of specialization is such that a theoretical knowledge is essential to success in many industries where chemical processes are utilized.

There are many men who, by close application to the practical side, have acquired responsible positions in technical industries, but are unfamiliar with the theoretical side of their chosen work.

Such men are unable to advance in their special lines, because they cannot read the many valuable books written on special technical subjects, which presuppose a general knowledge of the theory of chemistry.

At the present time, the requirements of admission to the higher institutions of learning, even for special students, are such that the doors are practically closed to these men, although many of them could take special courses with profit. Again, the only available hours for such men are during the evening. There is a demand, therefore, for a systematic evening course in chemistry, which will be open to men engaged at the present time in technical industries.

Regular Students

The school offers a thorough four year course in the general principles and applications of inorganic, organic and analytical chemistry, sufficiently complete to enable students to pursue their work with intelligence; to correlate theory and practice; to read technical works with profit; to test the quality and purity of chemicals and to become familiar with the laboratory methods of the trained chemist.

To the student who can pursue his studies an extra year, and who has had the necessary training, the school offers a course in chemical engineering. It is the aim of this course to prepare men to aid in the operation of industries based on chemical principles.

Special Students

Any of the courses in chemistry may be taken singly, pro-

vided the head of the department is satisfied that the student can pursue the work with profit.

Special courses may be arranged with the head of the department.

Students are especially urged to take the entire work on the schedule of each year. A good grounding in mathematics, physics and German, is essential to success in the chemical subjects of the third and fourth years.

Laboratories

The laboratories in the new building on Huntington Avenue are fitted with an excellent equipment in up-to-date apparatus, to give thorough instruction in all the courses offered.

A laboratory deposit of three dollars for the first year, and four dollars for all other years, must be paid before desks will be assigned. Students who have not checked up their desks by the end of the school year will be charged one dollar extra.

The School makes an effort to secure positions for those who have successfully completed the course in chemistry, or chemical engineering.

14. Inorganic Chemistry.

DR. SPEAR AND ASSISTANT.

A course of 56 experimental lectures on the fundamental laws and principles of inorganic chemistry. The course aims to familiarize the student with the properties and preparation of the following elements and their most important compounds:—oxygen, hydrogen, the halogens, sulfur, nitrogen, phosphorus, carbon, silicon, the alkali and alkaline earth groups, iron and aluminium. The course is to be taken in conjunction with (15).

Text book:

General Chemistry for Colleges, Smith.

15. Inorganic Chemistry Laboratory.

DR. SPEAR AND ASSISTANT.

A laboratory course of 28 weeks, 90 periods in which the student is expected to verify and illustrate the facts and principles that have been discussed in the lectures. To be taken in conjunction with (14).

Text book:

Laboratory Experiments in Inorganic Chemistry, Spear.
Courses (14) and (15) are well adapted to the needs of those who wish to take the College Entrance examinations.

16. Qualitative Analysis.

DR. SPEAR AND MR. STRAHAN.

Preparation, (14) and (15), or an equivalent.

A practical course in qualitative analysis of 28 weeks, 140 periods duration, in the second year. The course relates to the identification of the common metallic elements and the ordinary acids.

Each student is expected to make complete and accurate analyses of various mixtures, alloys and chemicals used in the industries. The laboratory work is supplemented by lectures and conferences.

Text books:

General Chemistry for Colleges, Smith;

Qualitative Chemical Analysis, A. A. Noyes.

17. Volumetric Analysis.

DR. MUELLER AND ASSISTANT.

Preparation, (14), (15), (16), or equivalent.

A course of 14 weeks, 98 periods, in the third year on volumetric determinations, involving the use and the standardization of burettes, pipettes, and measuring flasks. The course includes alkalimetry, acidimetry, indicators, oxidimetry, iodimetry, chlorimetry. The laboratory work is supplemented by lectures and conferences.

Text book:

Quantitative Chemical Analysis, Talbot.

18. Gravimetric Analysis.

DR. MUELLER AND ASSISTANT.

Preparation, (14), (15), (16), (17), or equivalent.

A course of 14 weeks, 98 periods, devoted to the principles and practice of gravimetric analysis. The laboratory work is supplemented by lectures and conferences.

Text books:

Quantitative Chemical Analysis, Talbot;

Analytical Chemistry, Treadwell and Hall, Vol. 2.

19. Organic Chemistry.

DR. MUELLER AND ASSISTANT.

Preparation, (14), (15), (16), (17), (18).

A course consisting of 196 periods during the fourth year. The course is devoted to lectures, conferences and laboratory work, on the principles of organic chemistry, as illustrated by the methane and benzene derivatives. The student is required to prepare in the laboratory a number of organic compounds, selected to show the characteristic reactions, and to give training in the practical separation and purification of organic substances. After this synthetic work, the students are given a practical course in organic analysis.

Text books:

Holleman, Text-book of Organic Chemistry; Gatterman, Practical Methods in Organic Chemistry, translation by Schober. Laboratory notes by the instructor.

20. Technical Analysis.

DR. MUELLER AND ASSISTANT.

Preparation, (19), or an equivalent.

A course of 28 periods in the fifth year, on the following:
Analysis of gases.

Analysis and testing of mineral, animal and vegetable oils.

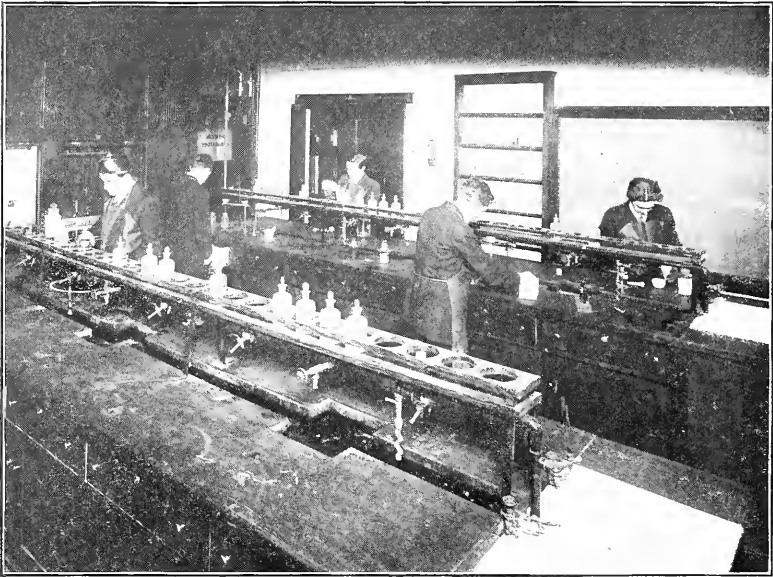
The origin, manufacture, properties, uses and analysis of the various fuels, and the determination of the heat value of fuels by the use of a calorimetric bomb.

21 and 22. Theoretical Chemistry I and II.

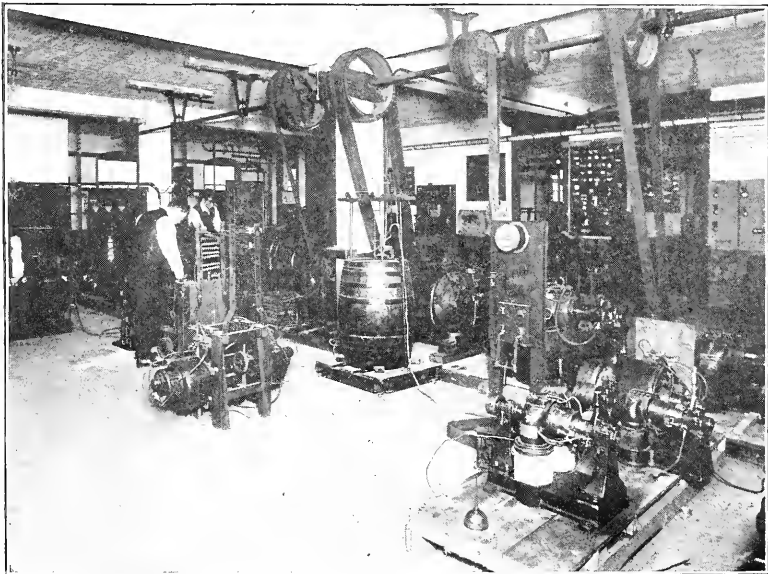
DR. SPEAR, DR. MUELLER.

Preparation, (2), (16), (17), (18).

A course of 56 lectures and conferences on chemical equilibrium and electro-chemical topics. The course will include lecture experiments and discussion of problems on the law of mass action applied to the rate and equilibrium of chemical reactions, the effect of temperature and pressure, the conduction of electricity by solutions, the production of electricity by chemical change, the electromotive force of voltaic cells and single potential differences. Problems for independent solution by the student will also be given.



CHEMISTRY LABORATORY
(One of Three)



CORNER OF ELECTRICAL LABORATORY

23. Industrial Chemistry.

Preparation, (16), (17), (18), (19).

A course of 28 lectures and conferences on the more important chemical processes. Attention is given to many operations of a general nature common to chemical industries, such as crushing, grinding, filtration, evaporation, distillation, etc., and to the apparatus employed in these processes. Some of the more important industries will be taken up in detail.

Text book:

Thorp, Outlines of Industrial Chemistry.

DEPARTMENT OF ELECTRICAL ENGINEERING

DIRECTOR: W. LINCOLN SMITH, S.B.

INSTRUCTORS: LOREN N. DOWNS, JR., S.B., A. L. GARDNER, S.B., MR. F. G. HARTWELL, MR. R. E. SMITH.

The school offers a thorough course in Electrical Engineering, combining theory with practice.

The laboratory equipment is very complete and suitable for teaching in a very effective manner. The object of all the laboratory work is to have the student expand the knowledge he has received from the lectures, and reading, by learning through his finger tips; to have him absolutely handle the object under discussion; to adjust, measure, and test electrical machinery; to become familiar with dynamos, motors, electric wires, and, in fact, to get an intelligent conception of the entire problem from a practical standpoint. In addition to the foregoing, however, it is aimed to supply sufficient theory so that the student may know why certain things are done, enabling him thereby to become a skilful operator and one capable of growth and development. When a man is in earnest, and attends regularly, he can acquire an intelligent conception and a working knowledge which has a direct and absolute commercial value.

In addition to the above regular courses of the School, it is intended that, if sufficient men apply to cover the cost, courses will be given on the subject of wireless telegraphy, induction coils and firing systems for gasoline engines, etc.

Also should a sufficient number of men apply to warrant the formation of a class, it is intended to arrange for a lecture

and laboratory course in telephony. This, however, would hardly be warranted for a less number than fifteen, and twenty would be better, as the expense of instruction and laboratory equipment would be large.

Students in the regular second-year course would not find it possible to take this in addition to their regular work, but might substitute it for a part of the same, after considering the matter with the Dean.

Although the second and third year courses of the long technical course are integral parts of the same, the work has been planned, so far as possible, to allow of any man having sufficient knowledge, entering at any point as a regular student, after satisfying the instructors of his capacity to carry on the work without hindrance to the other men; or, as a special student for such particular parts of the work as he may desire. Thus he may take either the whole of the second-year work, or any one, or more, of the courses which appeal to him, and the same in the third year. The expense will be arranged in each individual case according to its particular nature.

24. Electricity Ia. MR. HARTWELL.

A lecture course of 14 weeks duration on the following subjects:—Ohm's law, power measurements, batteries, annunciators, burglar alarms, gas lighting systems, electric wiring devices, new and old house work, moulding, conduit, knob, tube and cleat work, arc and incandescent lamps, two and three wire systems, different types of switches and their use, method of installing, testing and locating trouble.

25. Electricity Ib. MR. HARTWELL.

A lecture course of 14 weeks duration on the following subjects:—Different types of motors and controlling devices, methods of connecting and installing the same, fitting and setting brushes and common troubles and their causes, generators, different types, and connections for the same, how to take care and operate, common troubles and their causes, switchboards, different devices used on switchboards and their use, connections for all kinds of direct current, two and three-wire switchboards, booster and balancer sets explained, and connections given, location of generator and switchboards.

26. Electricity IIa. MR. HARTWELL.

A laboratory course of 14 weeks duration covering subjects given in electricity Ia.

27. Electricity IIb. MR. HARTWELL.

A laboratory course of 14 weeks duration covering subjects given in Electricity Ib.

28. Electricity III. MR. W. L. SMITH OR ASSISTANT.

This course of 28 weeks, 28 periods, consists of Lectures on the general principles of Electricity and Magnetism, including such matters as Resistance, Inductive reactance, Capacity reactance, Voltage and Current relations in complicated networks of circuits. The various Electrical Units of Measurement, and their dimensional equations, etc., in addition to the usual consideration of the Electrical phenomena given in the Electrical section of a general physics course, up to, and including the principle of Electromagnetic-induction, the intention being to lay a thorough foundation for the future more specialized branches of the course.

29. Electricity IV. MR. DOWNS OR ASSISTANT.

This is a Laboratory Course of 22 weeks, running parallel with Elect. III and Direct Current Practice, and designed to emphasize the understanding of the principles studied in these, as well as to give the student practice in the handling of instruments and the making of observations preparatory to the later courses which involve the precise testing of electrical machinery. Thus it includes such experiments as a study of the bridge principle, determination of a current by electrolysis, resistance by Ohm's law, magnetization of iron, measurement of the self induction of a coil, of the capacity of a condenser etc., on the one hand; and on the other, such experiments as the relation of speed and E. M. F. in an armature running at constant speed in a constant field; Variation of E. M. F. with field strength; potential distribution about the commutator; variation of candle power with voltage in the various types of incandescent lamps, operation of arc lamps etc.

30. Direct Current Practice. MR. HARTWELL, MR. DOWNS, AND ASSISTANT.

This Course of 28 weeks, 56 periods, begins at the point

where Elect. III leaves off and discusses the theory of direct current generators and motors, winding of D C Armatures,—and in general a careful and detailed consideration of the application of direct currents to the various industrial processes is given, except in so far as relates to railway work, the consideration of which is deferred to the special course on that subject. It is essentially a lecture course, though many of the lectures may take place in the laboratory, or power house, about the machine under consideration.

31. Switchboards and Apparatus. MR. HARTWELL.

This is a lecture course of 18 periods, in which is discussed the apparatus used upon switchboards, the planning of switchboards, connecting up, etc. It is not intended to consider in this course the complicated switchboards and devices used in large stations, but rather those used in small plants for public supply, isolated private plants, and control panels, as for stage lighting, etc.

32. Wiring and the National Code. MR. HARTWELL.

The consideration of appliances used in wiring of buildings and the methods of running circuits (so far as the electrical operation of the same is concerned) has already been taken up as a subdivision of Electricity I. The present course of 10 periods is given over to the consideration of various accepted methods of installing wires, the various rules of the National Electrical Code and their reason for being. This course will be a very thorough and valuable consideration of the Code, it being given by Mr. Hartwell, a member of the Executive Committee of the National Association of Electrical Inspectors, and under the immediate supervision of Mr. Smith, who is the Secretary of the same Association, as well as of the Mass. Association of Municipal Electrical Inspectors. As a result of this, mooted points of controversy over the exact meaning of the various sections of the Code, which arise between wiremen and inspection departments all over the country, as well as the decision of the chiefs of twenty-four of the most important inspection jurisdictions, both municipal and Fire Insurance Exchanges, are immediately available in the Class room. The course deals only with inside wiring and not with street distribution systems.

33. Alternating Currents I. (Theory of Alternating Currents).
MR. DOWNS.

Preparation: Elec. III.

This course of 40 lectures and recitations, during the first twenty weeks, in the third year, concerns itself with the general theory of alternating current circuits, and the application of these principles to various engineering problems. In connection with the work, considerable emphasis is attached to the solution of problems selected with particular reference to their engineering application.

34. Alternating Currents II. (Alt. Current Machinery).
MR. DOWNS AND MR. W. L. SMITH.

Preparation: Alternating Currents I.

This course of lectures, recitations, and problems, IIa consisting of 16 periods during the last eight weeks in the third year, and IIb of 20 periods during the first twenty weeks in the 4th year, is devoted to a careful discussion of the various types of alternating current machinery for the generation, transmission and distribution of power. The special properties of each machine are considered, for the machine as a unit, and also when it is a part of any electrical system. Some of the general considerations concerning long distance transmission are also discussed.

35. Alternating Currents III. MR. DOWNS AND MR. W. L. SMITH.

IIIa. A. C. Machinery Laboratory and Reports.

IIIb. Advanced D. C. and A. C. Laboratory and Reports.

Preparation of A. C. IIa and b.

This course consisting of 20 hours during the last eight weeks in the third year (A. C. IIIa), and 20 hours during the last eight weeks in the 4th year (A. C. IIIb) is a continuation of Elec. IV Lab. It includes such tests as efficiency, heating regulation and determination of characteristics for alternating current machinery. For the advanced laboratory work tests will be made on the power plant of the Y. M. C. A. buildings. In this course, particular attention will be paid to the reports, which are in every case to be complete engineering reports of

the work undertaken. The work in the laboratory will be supplemented by individual conferences.

36. Technical Electrical Measurements I. MR. W. L. SMITH.

This is a lecture course of twenty weeks, in which are discussed the principles of various methods of Electrical Measurement, as well as the different instruments used, particular attention being given to the precision of the methods, the sources of error in instruments, and means for their detection and elimination.

37. Technical Electrical Measurements II. MR. W. L. SMITH.

This is a Laboratory Course of twenty weeks parallel with the former, the various experiments including such as the Correct use of the Wheatstone Bridge, the Slide Wire Bridge, Insulation Resistance Testing, Calibration of Wattmeters, Calibration of Voltmeters and Ammeters by use of the Potentiometer, etc., in each case careful application of the principles of Precision of Measurements being required.

38. Central and Sub-Stations. MR. DOWNS.

A course of Lectures, 20 periods dealing with the layout, construction and operation of electric power generating stations, for the general distribution of electricity for light and power purposes, except that the peculiar characteristics of Railway Power stations are not considered. In this course will be taken up the switchboard devices necessary to this type of plant.

39. Power Transmission. MR. W. L. SMITH OR ASSISTANT.

In this course of 10 periods, will be considered the economic problem of power transmission, the principles governing the design of transmission lines, the construction of the line and the National Code Rules governing such lines, and some of the more important municipal and statutory requirements.

40. Electric Railways. MR. W. L. SMITH OR ASSISTANT.

A course of 18 periods, including lectures and practical examples of the following subjects: Train Resistance, Railway Motors and their characteristics, determination of equipments by speed time curves and train sheets, car construction and equipment, electric locomotives, rail bonding, trolley and third rail

construction, design of feeder and transmission lines, substation and power station equipment, power system determinations, storage battery traction, and steam railroad electrification by direct and alternating currents.

41. Heat Engineering: Thermodynamics and Boilers. MR. GARDNER.

A course of 28 hours in the study of the principles of thermodynamics; a discussion of the properties of gases, saturated and superheated vapors, especially of air and steam; of the flow of fluids through orifices, nozzles, pipes and meters, a discussion of the action of the steam injector; a study of the various cycles of the hot air, internal combustion and steam engines of the turbine, air compressor and refrigerator systems. These engineering applications are treated from the physical, analytical and graphical points of view, so as to give the student a good foundation in the principles of thermodynamics, in the solution of actual heat engineering problems. The course also includes a study of the simple, compound and multiple expansion steam engine, of the different types of gas engines, of the gas producer, of compressed air and refrigerator machines, and the methods of testing such machines.

The latter part of the course includes a study of the various types of steam boilers and the different kinds of power plant apparatus, including fans, blowers, economizers, condensers, feed pumps, etc. A short discussion of the construction and stability of chimneys is also given.

42. Hydraulic Motors. MR. GARDNER.

A course of 42 hours, mainly recitations covering the principles of hydrostatic and hydrodynamic pressure, the flow of water through open channels, pipes, orifices and nozzles and over weirs. Half the time is given to a study of impulse wheels and reaction turbines, with reference to their proper construction, regulation and testing, and to the various sources of loss of energy in their operation.

43. Colloquium. MR. W. L. SMITH AND MR. DOWNS.

The class will meet once a month, during the fourth year, for an entirely informal discussion of various matters appearing

from time to time in the Technical press. Subjects for discussion will be assigned to the various students several weeks ahead, and upon the allotted evening, a fifteen minute talk will be given by the student to whom the subject has been assigned and the remainder of the time to an open discussion of the same, the instructor acting as moderator of the meeting. This work, too, will be of great value to the student as a means of learning to absorb a subject, impart his information to others, and to maintain his position effectively in argument, as well as learning to acknowledge a mistake, gracefully, yield to the logical scientific correctness of another's argument, and in general to gain a more scientific and reasoning mental attitude.

44. Thesis.

During the final year, each student in order to qualify for a diploma, must prepare and present a report upon some piece of original work, investigation of some piece of machinery, consideration of some practical problem, or similar subject, the students working either alone or in pairs, and at such time as they please, within limits, the subjects being selected in consultation with one of the instructors, who will have immediate supervision of the work.

The object of this work is to develop the student's powers of original investigation and to teach the principles upon which the study of special problems of various kinds should be approached. It is hardly expected that the immediate results of the investigation will be of great value, in view of the time allowable, considered as contributions to engineering knowledge, but it is expected and believed that the value to the student himself will be very great.

DEPARTMENT OF STRUCTURAL ENGINEERING

INSTRUCTORS: MR. C. S. ELL, M.S. AND MR. LESTER GUSTIN.

The four years' course in structural engineering covers thorough instruction in mathematics, mechanics and the theory and practice of drafting, detailing, estimating and designing. Thorough instruction is given by means of lectures and classroom work in the important theoretical and practical principles of design, supplemented by the execution of detail drawings in the drafting room.

45. Elementary Mechanics.

This course in the first year is devoted to the elementary principles of mechanics and is designed to familiarize the student with the fundamental principles of statics, stresses in frames and dynamics so that the work of the succeeding years will be more readily grasped.

46. Structural Drawing.

The course in structural drawing occupies one evening a week throughout the entire second year. The course consists in the working out of various graphical problems of mechanics on the drawing board, drawing standard sections of structural steel shapes, plotting shear and moment diagrams and the preparation of drawings, representing elementary structural details. The purpose of this course is to familiarize the student with detailed drawings and teach him where and how to dimension structural parts on working drawings.

47. Structural Design.

The course in structural design consists of work in the drawing room, one complete evening each week throughout the third year. It is a continuation of the course in structural drawing given in the second year, and includes the execution of elementary structural design, taking up in a practical way the principles given in the course in Theory of Structures. Each student is given data for various problems, the designs for which he works out in the drawing-room, making all necessary computations and executing all drawings necessary for the preparation of a complete design of a number of engineering structures.

48. Bridge Design.

The course in bridge design occupies one complete evening a week throughout the fourth year. Most of the work is done in the drawing-room, but instruction is given from time to time by means of lectures. The work includes the execution of complete designs for several types of railroad bridges and the execution of complete working drawings.

49. Structural Mechanics.

This course consists of one period on Monday and Friday evenings, throughout the second year. The course covers the

fundamental principles of statics, the computation of shear and moment diagrams, a study of the centre of gravity and the moment of inertia of plane figures and the application of the various principles of mechanics to the solution of simple structural problems. The work consists of lectures, recitations and the solution of problems, many of which are done in the drawing-room.

50. Theory of Structures.

This course occupies one period on Monday and Friday evenings throughout the third year and consists of lectures, recitation and solution of problems. In this course instruction is given in the fundamental theory of structures including the theory of beams, computation of reactions, moments, shears for static and moving loads. The work in the class-room is supplemented by the solution of many practical problems in the drawing-room.

51. Strength of Materials.

This course occupies one period on Monday and Friday evenings throughout the third year, consisting of lectures, recitations and the solution of problems. Instruction is given in the properties of various building materials, such as stress, strain and the various elastic properties of the different materials. Study is also made of the strength, composition and adaptability of steel, timber, stone, concrete and various other materials for use in structures.

The common theory of beams is also studied with a thorough discussion of the distribution of stress, shearing forces, bending moments, slopes and deflections.

52. Advanced Structures.

This course occupies one period on Monday and Friday evenings, throughout the fourth year. It is a continuation of the theory of structures given in the third year and takes up the fundamental principles involved in the design of various engineering structures, such as buildings, bridges, retaining walls, arches and other structures, as the time permits. Instruction is given by means of lectures and recitations and the various theoretical principles are applied in the execution of practical designs in the drawing-room.

53. Reinforced Concrete.

This course occupies one period on Monday and Friday evenings, throughout the fourth year. The various principles of design of structures of reinforced concrete are taken up by means of lectures. Instruction is given in the theory and practice of reinforced concrete construction and the student solves many problems illustrating the computations for design of beams, girders, floor slabs, columns, footings, retaining walls, etc. Some of these problems are worked out and drawings are made in the drawing-room.

DEPARTMENT OF RAILROAD ENGINEERING AND MUNICIPAL ENGINEERING

INSTRUCTORS: JOHN W. HOWARD, S.B., CHARLES H. RESTALL, S.B.

The school offers a complete course in Municipal Engineering to meet an urgent demand for instruction in this Department. The course, extending over a period of four years, has been prepared with great care and it is believed will meet the requirements of those who wish to equip themselves for Town, or City Engineers.

Students wishing to take separate courses may do so on approval of the Dean.

54. Topographical Drawing.

This course of 20 weeks in the second year, is primarily designed to give training in the interpretation and drawing of topographical maps. It consists of three hours per week in the drawing-room, devoted to the study of the different conventional signs employed, and each student is required to make a number of plates, and to become reasonably proficient in the preparation of such maps. Particular attention is given to the study of contour maps, and the solution of problems relating thereto.

55. Stereotomy.

A course of 2 periods per week, during the last ten weeks of the second year, in the applications of Descriptive Geometry

to the making of drawings in connection with the design of masonry structures, such as intersecting arches and walls, abutments, piers and culverts.

56. Surveying and Plotting. MR. HOWARD.

Preparation: Trigonometry or Math. II (2)

The course in surveying consists of 3 hours instruction each week during the second year, in the theory of plane surveying, with field exercises on Saturday afternoons in the Fall and Spring.

During the first term, the field work consists of practice in the use of the transit and tape in making surveys for determining areas and for making plans. The class work includes methods of computing areas, subdividing land, and all of the common problems of plane surveying.

The second term is devoted chiefly to drawing. Students are required to plot a survey of a city lot, on a scale of 40 feet to an inch, to draw a plate of conventional signs used in topography, and to plot a topographical map on a scale of 100, or 200 feet to an inch.

In the spring, the field work consists of practice in using the level for establishing bench marks, running profiles, cross sectioning, etc. The class work includes problems in the use of contour maps, plotting profiles, estimates of earthwork, etc. If time permits, instruction is given in stadia and plane table surveying.

57. Advanced Surveying. MR. HOWARD.

Preparation: Surveying and Plotting (56) or equivalent.

This course occupies 2 periods per week during the first twenty weeks of the third year and covers the following subjects:

Triangulation: reconnaissance, base-line measurement, signal building, use of heliotropes, measurement of angles, calculation of triangles, calculation of geodetic positions.

Astronomical Observations: observations for latitude, observations for time and longitude, determination of azimuth.

Leveling: precise spirit leveling, trigonometric leveling, barometric leveling.

Topographic Methods: transit and stadia method, plane-table method.

Hydrographic Surveying: methods of locating soundings, use of sextant, measurement of stream flow.

Map Projections: study of the principal projections used in constructing maps.

Exercises in fieldwork will be held Saturday afternoons.

58. Materials of Construction.

A course of one and one half hours per week during the third year, taking up a consideration of the properties of the various materials used in engineering construction, such as wood, iron, steel, brick, stone, cement and concrete.

59. Foundations.

A course of one hour per week during the last eight weeks of the fourth year.

The subjects treated in this course are as follows: Building stones and concrete, bearing power of different kinds of soil, examination of the site, designing the footings, whether of masonry, or of steel and concrete, independent piers, pile foundations, compressed air processes, freezing processes, retaining walls, together with some details of buildings for industrial purposes, constructed of steel or of reinforced concrete.

60. Highways.

A course of two and one half hours per week during the last eight weeks of the second year, in which are treated the following subjects:

The construction of roads and city streets, the problems of drainage and maintenance, qualities of trap rocks, good gravel, binding materials, paving blocks and bricks, concrete foundations, and the uses of asphaltic oils and other bituminous materials.

61. Hydraulics.

A course of one and one half hours per week during the fourth year. The course consists of two parts. The first is devoted to the study of theoretical hydraulics dealing with hydrostatic and hydrodynamic pressure, the flow of water through channels, pipes, orifices and nozzles and over weirs. The second part deals with such practical problems as the study of stream flow and storage and the development of water power.

62. Sanitary Engineering.

A course of 65 hours during the fourth year, consisting of the study of water supply and sewage disposal and their relation to public health, the sources of water supply, tests for purity, bacteria, etc., the design of a sewage disposal system, septic tanks, filter beds, and the collection and disposal of garbage wastes.

63. Municipal Engineering Problems.

A course of 28 weeks in the fourth year dealing with various engineering problems encountered by town and city engineers such as construction of sewers, retaining walls, bridges, grade crossing problems, making of contracts, and writing specifications for various construction work, methods of inspection, and handling of public service properties, such as poles, lines, conduits, tracks, etc.

64. Railroad Engineering. MR. RESTALL.

A course of three hours per week during the fourth year. It includes the study of the following:

Railroad location, as influenced by topographical features, purpose, grades, pusher grades, length of line curvature, rise and fall. Field work and making of location plans.

Computation and methods of laying out of simple, compound, reverse and easement curves. Circular and parabolic curves in connection with gradients. Practical curve problems.

Earthwork, slope stakes, cross-sections, burrow pits, methods of computations, tables and diagrams.

Frogs, switches, turnouts, cross-overs, crossing frogs, turnout tables, track, track laying, rail, ballast and drainage.

Yard design, passenger and freight yards, gravity yards, hump yards, yard accessories, stations, terminals, elimination of grade crossings, methods of construction and making estimates.

Draughting. The course will be supplemented to some extent by draughting and by railroad designing.

Fieldwork. Where necessary to illustrate the principles involved in the course, exercises will be given in the field on Saturday afternoons in the spring.

Preparation. Algebra, geometry, trigonometry, surveying.

If not qualified by having passed the above subjects, a student may be admitted as a special student on approval of the instructor of the course with the consent of the dean.

65. Applied Mechanics.

This course of sixty hours comprises a study of general methods and applications of statics, including the determination of stresses in frames; of centre of gravity, moment of inertia and radius of gyration; of kinematics and dynamics including uniform and varying rectilinear and curvilinear motion, centrifugal force, momentum, impact, work, power and kinetic energy.

Equipment

DEPARTMENT OF PHYSICS

There is a large laboratory devoted entirely to Physics together with a lecture room.

This year the Physics Department has been very completely equipped with all necessary apparatus for the experimental work that is required of the students, as well as that required for lecture demonstration. Among other things, have been added: verniers, levels, spherometers, calorimeters, thermometers, pyrometers, a spectroscope, a microscope, a spectrometer, balances, standard gram weight, lecture table galvanometer, optical disk with all accessories, lenses, photometer, a full set of Weather Bureau apparatus including a barograph, thermograph, hygrometer, barometer, maximum and minimum thermometers, etc. These, in addition to the equipment already owned, give a wide range to the experimental work that can be done.

In addition to the foregoing we are preparing to add a large number of new pieces of apparatus, for work in mechanics, heat, and light, and at the time of going to press are getting out specifications so that they may be built for use next year.

DEPARTMENT OF CHEMISTRY

This Department is completely equipped in all respects for carrying on all lines of Chemical work, from that of a High School to that of most advanced College grade. The three laboratories, with accommodations for over one hundred and fifty students, are very exceptionally furnished with all the necessary appliances for chemical work. Some of these are: hoods, drying closets, still, steam and hot water baths, electrolytic circuits, vacuum and pressure apparatus, balances, combustion furnaces, complete sets of apparatus for the sampling and analysis of flue gases and fuels. There are also testing machines for oils, viscosimeters, and different sorts of flash point apparatus. A chemical museum is connected with this Department where are kept specimens for purposes of illustration.

DEPARTMENT OF MECHANICS

Mechanical Laboratories.

There is a completely equipped steam engineering laboratory in the new building where students may make practical boiler and fuel tests, as well as study steam engineering practice. In addition to a complete modern power plant used for lighting and heating the buildings, there are several engines used wholly for instruction purposes. The students also have the use of the equipment of our Automobile School, thus giving opportunity to study the most advanced ideas in gasoline engine practice.

Mechanic Arts Laboratories.

There are two large laboratories, one for metal work and the other for wood work. These are for the use of those students who wish instruction of this character. The metal working laboratory is now in use in connection with the Automobile School and includes: one large and one small drill press, one large and one small engine lathe, a high-speed lathe, emery wheel, shaper, grinding machine, electric drill and milling machine, together with the necessary equipment for complete machine, and bench work instruction.

The wood working laboratory includes planers, saws, steam boxes and benches, together with all necessary equipment for complete instruction in practical woodworking.

DEPARTMENT OF ELECTRICITY

The Electrical Laboratory is well equipped with apparatus for teaching the principles of measurements, and the equipment is being steadily increased and developed for the doing of work of a higher degree of precision. Among the special pieces of apparatus may be mentioned the following: Cary Foster Bridge, a modified form of Hoopes Conductivity Bridge, a Laboratory Wheatstone Bridge, a Leeds Northrup Potentiometer with Volt box, standard cells and low resistance standards, an accurate Chemical Balance and other appliances for the close determination of currents, resistances and potential differences.

There has been added this year, a set of variable inductances, and a set of condensers to the amount of eighty microfarads capacity variable in steps of one tenth microfarad each.

Among the instruments for testing purposes, for alternating current work, may be mentioned the following: Three matched voltmeters and three General Electric Type P-3 Iron clad wattmeters arranged for Y connection, six other voltmeters of various ranges, potential transformers, nine ammeters some with current transformers, three integrating meters, one General Electric and one Westinghouse polyphase, switchboard type, integrating wattmeters and a High Torque General Electric test meter. There is also a considerable and increasing assortment of auxiliary testing apparatus, such as synchronism indicators, power factor indicators, frequency indicators, etc.

For direct current testing, there is a large and increasing collection of Weston instruments, both voltmeters and ammeters, of suitable ranges and grades of precision, while the measurement of unusual currents and voltages is ensured by three Weston millivoltmeters with an assortment of standard shunts and multiplying resistances of various orders of magnitude.

There is also the usual assortment of testing devices, such as speed indicators, tachometers, brakes, loading resistances and the numerous minor pieces of apparatus needed in practical testing and operating of electrical machinery.

Among the machines of this Department, are a pair of specially made, matched machines arranged to run as single phase, two, or three, phase generators, or motors, as well as synchronous transformers, double current generators, or on the Direct Current side as shunt, series, or compound generators, either two or three wire, or as motors.

There are also a 15 horse power 230-volt Westinghouse motor, a new General Electric 10 horse power Interpole 230-volt motor, a 500-volt generator, two 500-volt series, and several 500-volt shunt motors, and a series parallel controller.

A 45 K. V. A., 60-cycle, single phase, 500-volt generator giving a practically pure sine wave, three General Electric Type H transformers of 5 K. V. A. capacity, a $7\frac{1}{2}$ K. V. A. special General Electric 60-cycle 250-volt alternator, with

revolving field tapped for either 1, 2, 3 (star or mesh connection) 6 or 12 phase connection, which may be operated (by the substitution of special rotors) also as a synchronous, or induction motor, or a frequency changer. It is intended, in the near future, to add a duplicate of this machine with another interpole motor to drive it, thus obtaining a matched pair of machines, which, with the transformers, will enable a very wide range of alternating current experimentation to be carried out.

There is also available for advanced instruction, in co-operation with the Mechanical Department, the four three-wire generators (two driven by reciprocating engines and two by Westinghouse-Parsons turbines) in the main generating plant of the Association.

LIBRARIES

There is in connection with the School a professional library containing books pertaining to both the school work of the boys and to their practical work. In addition to this there also are current periodicals on engineering and scientific subjects for their exclusive use.

DEPARTMENT OF PHYSICAL TRAINING

Our new gymnasium with all the latest modern equipment gives ample accommodation for all students.

There is a running track on the grounds adjoining, together with tennis and hand ball courts; also a large natatorium where swimming is taught by competent instructors.

In connection with this Department, there are also six excellent bowling alleys, which may be used by the students upon the payment of a nominal fee.

Additional Information

The School reserves the right to retain for its annual exhibition, and for any other purpose which it may deem necessary, drawings made by students.

Scholarships.

As an aid to worthy men who desire an education and are unable to pay in full even our slight charges, a limited number of scholarships have been provided, which will be judiciously distributed by the Educational Committee, to whom application should be made.

Entrance Requirements.

Any man of good character, regardless of age, occupation or creed, with adequate general education may be enrolled in the School.

A student may elect any subject, or combination of subjects, which best serves his particular needs. However, to prevent loss of time and expense to the student, he will not be allowed to elect courses which, on account of inadequate preliminary training and experience, he could not pursue with profit. The Dean should be consulted before registration.

Certificates.

Upon the satisfactory completion of any of the regular, or special courses, the student is entitled to receive a certificate. No certificates will be given, however, unless the student has successfully performed the prescribed work and passed the necessary examinations.

Suburban Members.

All tickets held by members of the Cambridge, Chelsea, Everett, Lynn, Malden, Melrose, Newton, Quincy, Salem and Somerville Associations, will be honored for membership in the Boston Association.

Schedule of Rates

Courses I and II (Chemistry and Electrical Engineering).

First year, \$35, including membership, payable as follows:—\$15 upon entering, \$10 November 15, and \$10 January 15.

Second, third and fourth years, \$50 each, including membership, payable as follows:—\$20 upon entering, \$15 November 15, and \$15 January 15.

Courses III, IV and V (Structural, Railroad and Municipal Engineering).

First year \$30, including membership, payable as follows:—\$10 upon entering, \$10 November 15, and \$10 January 15.

Second, third and fourth years, \$50 each, including membership, payable as follows:—\$20 upon entering, \$15 November 15, and \$15 January 15.

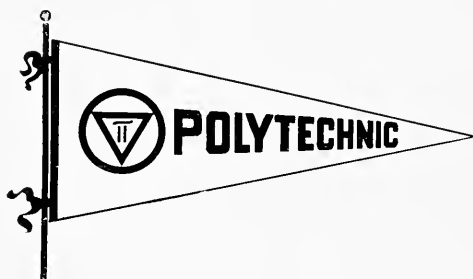
Special Note—The following rates are in addition to membership (\$2). In case more than one course is taken, a discount of \$3 for each additional course will be made.

Course	Tuition	Course	Tuition
52 Advanced Structures	\$24.00	12 Life Class	\$20.00
57 Advanced Surveying	24.00	5 Machine Drawing	11.00
33 Alternating Currents I	13.00	58 Materials of Construction	24.00
34 Alternating Currents II	18.00	1 Mathematics I	13.00
35 Alternating Currents III	18.00	2 Mathematics II	18.00
65 Applied Mechanics	18.00	3 Mechanical Drawing I	
6 Architectural Drawing I	9.00	4 Mechanical Drawing II	9.00
7 Architectural Drawing II	9.00	63 Municipal Engineering	24.00
8 Architectural Drawing III	13.00	19 Organic Chemistry Prob.	50.00
48 Bridge Design	24.00	13 Physics	18.00
38 Central and Substations	24.00	39 Power Transmission	13.00
30 Direct Current Practice	24.00	16 Qualitative Analysis	32.00
24 Electricity Ia	13.00	64 Railroad Engineering	28.00
25 Electricity Ib	13.00	53 Reinforced Concrete	24.00
26 Electricity IIa	13.00	62 Sanitary Engineering	24.00
27 Electricity IIb	18.00	55 Stereotomy	18.00
28 Electricity III	18.00	51 Strength of Materials	24.00
29 Electricity IV	18.00	47 Structural Design	24.00
40 Electric Railways	20.00	46 Structural Drawing	24.00
45 Elementary Mechanics	13.00	49 Structural Mechanics	24.00
59 Foundations	13.00	56 Surveying and Plotting	24.00
9 Freehand Drawing I	8.00	31 Switchboards and Apparatus	18.00
10 Freehand Drawing II	8.00	20 Technical Analysis	25.00
41 Gravimetric Analysis	25.00	36 Tech. Elect. Measurements I	18.00
17 Heat Engineering	18.00	37 Tech. Elect. Measurements II	18.00
60 Highways	18.00	21 Theoretical Chemistry I	18.00
61 Hydraulics	18.00	22 Theoretical Chemistry II	18.00
42 Hydraulic Motors	18.00	50 Theory of Structures	24.00
11 Industrial Design	8.00	54 Topographical Drawing	18.00
23 Industrial Chemistry	18.00	17 Volumetric Analysis	16.00
14, 15 Inorganic Chemistry	24.00	32 Wiring and Nat. Code	18.00

The tuition for all courses payable in advance unless stated to the contrary, in which case times of payment are indicated. Numbers preceding courses refer to description of courses, pages 16 to 41.

Students who discontinue a course, but who have attended four or more recitations in the subject, will be required to pay a term's tuition.

No student is permitted to transfer from one course to another without consulting the Dean beforehand and receiving a transfer order which must be presented at the main office for the proper ticket.



POLYTECHNIC ASSOCIATION

This is an organization formed and managed by the students. Its object is to provide social gatherings for the Polytechnic students, and to establish a bond of friendship among the men.

All men entering the Polytechnic School may join this association by filling out the proper blank at the educational office. Membership is free.

A school pin, pennant and engraved stationery with Polytechnic design may be ordered by the members.

The present board of officers are planning a number of entertainments and a lively season for 1914-15.

OFFICERS FOR 1914-15

R. R. GREENLEAF, *Pres.*

M. I. MORANDA, *Vice Pres.*

N. J. BUSBY, *Sec.*

P. A. WAKEMAN, *Treas.*

GENERAL DEPARTMENTS

DEPARTMENT OF PHYSICAL WORK

ALBERT E. GARLAND, M.D., B.P.E., Director

The Physical Department is under the best supervision and the aim is to better fit men for their life work by increasing their efficiency, through exercise. We offer: Well equipped gymnasiums, Recreative, Hygienic and Educational Gymnasiums. Numerous classes the year round. Shower, steam and electric baths. Best instruction. Medical direction. Hand ball courts.

DEPARTMENT OF RELIGIOUS WORK

EDWIN W. PEIRCE, Director

In order that a young man may secure a well-balanced development and attain a spiritual foundation for successful life work, the Association advises each member in planning his schedule to enter into one or more of the following activities:—

Bible Study, Sunday Meetings of Men, Personal Service Groups and The Twenty-Four-Hour-A-Day Club.

DEPARTMENT OF SOCIAL WORK

DAVID M. CLAGHORN, Director

The attention of members is called to the many opportunities in the Association for social service, and the following social features.

A Newly Equipped Game Room. The Popular Novel Club.
The Association Congress. The Land and Water Club.
Popular Social Evenings.

DEPARTMENT OF EMPLOYMENT

FREDERICK W. ROBINSON, Director

The Employment Department is, in actual practice, a clearing house for young men seeking work, and employers who wish to engage reliable help. From 5000 to 8000 men apply every year. Members of the Association are given 25 per cent discount from the legal rates and special effort is made to notify them when good positions are open.

BOYS' DEPARTMENT

DON S. GATES, A.B., City Secretary

The physical, social, employment and religious advantages offered to boys from twelve to eighteen years, are similar to those offered to men, as stated above. Membership dues for the boys range from one to six dollars, according to the privileges desired.

THE
EVENING
POLYTECHNIC
SCHOOL

CATALOG
1915-1916



EVENING COLLEGE COURSES

PUBLISHED BY THE
DEPARTMENT OF EDUCATION
OF THE
BOSTON YOUNG MEN'S CHRISTIAN ASSOCIATION
316 HUNTINGTON AVENUE
BOSTON, MASS.

DEPARTMENT OF EDUCATION

BOSTON YOUNG MEN'S CHRISTIAN ASSOCIATION

EVENING LAW SCHOOL

Evening Sessions Only

Established in 1898; incorporated in 1904. Provides a four years' course in preparation for the Bar and grants the Degree of Bachelor of Laws.

SCHOOL OF BUSINESS

Day and Evening Sessions

Offers all of the courses of the regular Business School program, and additional cultural courses, preparing for business and admission to our School of Commerce and Finance.

SCHOOL OF COMMERCE AND FINANCE

Evening Sessions

Established 1907; incorporated 1911. Offers the following four-year courses leading to the degree of B.C.S. (Bachelor of Commercial Science): Banking, Business Administration, Finance and Bond Salesmanship, and Professional Accountancy. Anyone passing the examination for advanced standing, is enabled to complete any one of the four regular courses and secure the degree in three years. Special courses in addition to regular courses.

PREPARATORY SCHOOL

Evening Sessions

A school of high school grade to prepare students for Colleges, Scientific Schools, West Point, Annapolis, Lowell School for Industrial Foremen, and the classified Civil Service.

HUNTINGTON SCHOOL

Day Sessions

A high-grade school, consisting of a Grammar Department (5th, 6th, 7th and 8th grades), a Preparatory Department, fitting for the Colleges, Medical and Dental Schools, Massachusetts Institute of Technology, Annapolis, West Point, Lowell School for Industrial Foremen, Law Schools and the classified Civil Service, and a Technical Department, fitting for positions along engineering lines.

CO-OPERATIVE ENGINEERING SCHOOL

Day Sessions

Four years' courses of college grade in Chemistry, Mechanical and Civil Engineering, etc., in co-operation with business firms. Students earn while learning. Open to High School graduates.

AUTOMOBILE SCHOOL

Day and Evening Sessions

Deals with the construction, care, repair and operation of all types of gasoline vehicles; a large staff of teachers; ample equipment and garage.

For further information concerning any of the above schools, or departments, address the Director of Education.

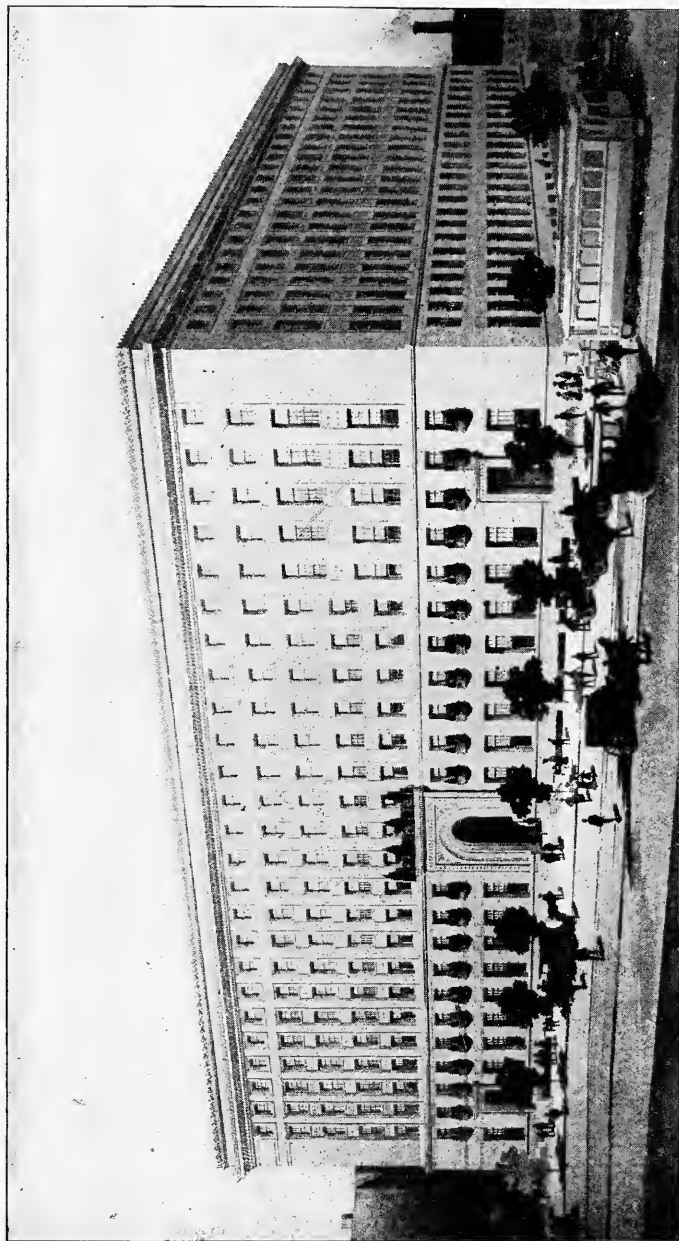
FRANK PALMER SPEARE,
316 Huntington Avenue,
Boston, Mass.

CATALOG
OF THE
EVENING POLYTECHNIC
SCHOOL

1915-1916



PUBLISHED BY THE
DEPARTMENT OF EDUCATION
OF THE
BOSTON YOUNG MEN'S CHRISTIAN ASSOCIATION



THE ASSOCIATION BUILDING

This is a picture of the Association Building which was finished in the Fall of 1913. It contains among other features, school accommodations of the very best, a fine gymnasium, bowling alleys, swimming pool, cafe, dormitories, shops and laboratories, library and reading room, camera club rooms, social and recreative rooms, and auditorium.

Calendar

1915-1916

Sept. 14-18	Registration
Sept. 20	Opening of school
Oct. 12	Columbus Day, Holiday
Nov. 25	Thanksgiving Day, Holiday
Dec. 20-25	Christmas Recess
Feb. 22	Washington's Birthday, Holiday
April 8	Close of school

Officers of Administration

General Administrative Officers

ARTHUR S. JOHNSON, *President*

ALBERT H. CURTIS, *Vice-President*

GEO. W. BRAINARD, *Recording Secretary*

LEWIS A. CROSSETT, *Treasurer*

GEORGE W. MEHAFFEY, *General Secretary*

Educational Committee

WILLIAM E. MURDOCK

ALBERT H. CURTIS

WM. C. CHICK

MORGAN L. COOLEY

GEORGE H. MARTIN

Educational Administrative Officers

FRANK P. SPEARE, *Director of Education*

GALEN D. LIGHT, *Asst. Director of Educ. and Bursar*

WALTER G. HILL, *Asst. Bursar*

CHARLES B. GRAY, *Secretary*

ERNEST H. BROOKE, *Registrar*

F. L. DAWSON, *Field Secretary*

Officers of Instruction

THOMAS E. PENARD, S.B., *Mass. Inst. Tech.*
DEAN

H. H. AMBLER, S.B.
Structural Engineering

JAMES BROUGH
Freehand Drawing and Industrial Design

LOREN N. DOWNS, JR., S.B.
Electrical Engineering

CARL S. ELL, S.B., M.S.
Structural Engineering

C. A. FARWELL, S.B.
Structural Engineering

FRED G. HARTWELL
Electrical Practice and Construction

JOHN W. HOWARD, S.B.
Surveying

H. C. MABBOTT, S.B.
Mechanical Engineering

EDWARD MUELLER, A.B., PH.D.
Chemistry

THOMAS E. PENARD, S.B.
Mathematics

M. F. PINKHAM
Mathematics

CHARLES H. RESTALL, S.B.
Railroad Engineering

O. R. SCHURIG, S.B.
Electrical Engineering

E. W. G. SMITH
Mechanical Drawing

R. E. SMITH
Electrical Practice and Construction

W. LINCOLN SMITH, S.B.
Electrical Engineering

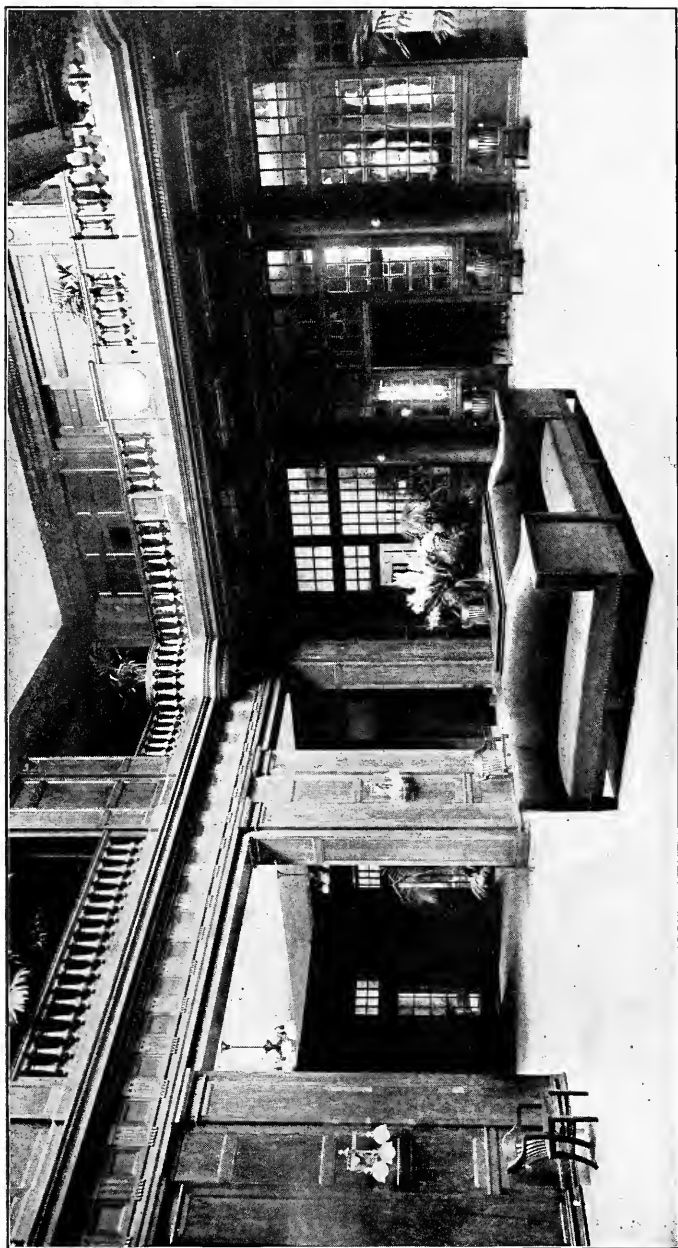
ELLWOOD B. SPEAR, A.B., PH.D.
Chemistry

SAMUEL A. S. STRAHAN
Chemistry

GEORGE A. TRUELSON
Architecture

P. A. WAKEMAN
Electrical Practice and Construction

W. F. WILLMANN
Mechanical Drawing



MAIN LOBBY

Foreword

Many men employed in engineering and other work of a technical nature, feel the need of special instruction but cannot afford to take the time to attend the regular technical day schools. To such men the Evening Polytechnic School offers a large number of special courses, and to those who are willing to give three evenings per week for a period of from three to five years the school offers several regular courses of very high grade which compare favorably with similar courses given in the good technical schools of the country.

The courses offered in this school are with a very few exceptions of college grade, so that the graduates will find themselves trained to meet the problems arising in engineering practice. They are sufficiently well equipped to hold important positions, and acquit themselves creditably.

On the following pages will be found a complete description of the regular and special courses, requirements for admission, rates of tuition and other general information.

Courses of Study

Regular Courses

- I.—Chemistry and Chemical Engineering
- II.—Electrical Engineering
- III.—Structural Engineering
- IV.—Railroad Engineering
- V.—Municipal Engineering

Schedule of Subjects

No.	Course	No. Weeks	Evenings	Time
1	Mathematics P	28	Mon., Fri. Sect. A	7.00-7.45
			Sect. B	7.45-8.30
2	Mathematics I	28	Mon., Fri. Sect. A	7.00-7.45
			Sect. B	8.30-9.30
3	Mathematics II	28	Mon., Fri. Sect. A	7.00-7.45
			Sect. B	8.30-9.30
10	Mechanical Drawing P	6	Wed. (or Thurs.)	7.00-9.30
11	Adv. Mech. Drawing and Orthographic Projections	28	Wed.	7.00-9.30
12	Machine Drawing	28	Wed., Fri.	7.00-9.30
20	Architectural Drawing I	28	Mon., Fri.	7.00-9.00
21	Architectural Drawing II	28	Mon., Fri.	7.00-9.00
22	Architectural Drawing III	28	Mon., Fri.	7.00-9.00
30	Freehand Drawing I	28	Tues., Sat.	7.30-9.30
31	Freehand Drawing II	28	Tues., Sat.	7.30-9.30
35	Industrial Design	28	Tues., Sat.	7.30-9.30
38	Life Class	28	Tues., Sat.	7.30-9.30
40	Inorganic Chemistry Lect.	28	Mon., Fri.	7.00-7.45
41	Inorganic Chemistry Lab.	28	Wed.	7.00-9.30
42	Qualitative Analysis	28	Mon., Tues.	A
43	Volumetric Analysis	14	Mon., Tues.	A
44	Gravimetric Analysis	14	Mon., Tues., Wed.	A
45	Organic Chemistry	28	Mon., Tues., Wed.	A
46	Technical Analysis	28	Mon.	A
47	Theoretical Chemistry I	28	Wed.	8.30-9.30
48	Theoretical Chemistry II	28	Fri.	7.00-7.45
49	Industrial Chemistry	28	Mon.	7.45-8.30
60	Practical Electricity	28	Mon., Fri.	7.00-7.45
61	Practical Electricity, Lab.	28	Wed. (or Thurs.)	7.00-9.30
62	Elem. of Elect. Engineering; Direct Currents	28	Mon., Fri.	7.45-9.30
63	Elect. Engineering, Lab., Direct Currents	28	Thurs.	7.00-9.30

No.	Course	No. Weeks	Evenings	Time
64	Elem. of Elect. Engineering; Alternating Currents	28	Mon.	8.00-9.30
65	Elect. Engineering, Lab. Alternating Currents	5	Fri.	7.00-9.30
66	Technical Elect. Measurements	28	Mon.	7.00-8.00
67	Tech. Elec. Measurements, Lab.	23	Fri.	7.00-9.30
68	Adv. Alternating Currents	28	Mon.	7.00-8.00
69	Elec. Eng., Lab.; Advanced	28	Thurs.	7.00-9.30
70	Electricity Supply Stations	28	Fri.	7.00-7.45
71	Power Transmission	14	Mon.	8.00-9.30
72	Electric Railways	14	Mon.	8.00-9.30
78	Thesis	28	Fri.	8.00-9.30
80	Heat Engineering	28	Thurs.	8.30-9.30
100	Practical Physics	28	Mon., Fri.	8.30-9.30
110	Structural Drawing	28	Wed.	7.00-9.30
111	Structural Design	28	Wed.	7.00-9.30
112	Bridge Design	28	Wed.	7.00-9.30
113	Structural Mechanics	28	Mon., Fri.	7.00-8.30
114	Theory of Structures	28	Mon., Fri.	7.00-8.15
115	Strength of Materials	28	Mon., Fri.	8.15-9.30
116	Advanced Structures	28	Mon., Fri.	7.00-8.30
117	Concrete Construction	28	Mon., Fri.	8.15-9.30
130	Topographical Drawing	20	Tues.	7.00-9.30
131	Surveying and Plotting	28	Mon., Fri.	7.00-8.30
135	Materials of Construction	28	Wed.	7.00-8.30
140	Foundations	8	Thurs.	7.00-8.30
145	Highway Engineering	8	Tues.	7.00-9.30
150	Hydraulic Engineering	28	Thurs.	8.30-9.30
151	Hydraulic Motors	28	Thurs.	7.00-8.30
155	Sanitary Engineering	28	Mon., Thurs.	7.00-8.30
160	Municipal Eng. Problems	28	Thurs.	7.00-8.30
165	Railroad Engineering	28	Mon., Fri.	7.00-8.30
170	Applied Mechanics	20	Mon., Fri.	7.00-8.15
180	English P	28	Mon.	7.00-8.30
185	German I	28	Wed.	7.00-7.45
186	German II	28	Wed.	7.45-8.30

A. Hours of instruction will be announced at opening of school.

Note: For prices see schedule of rates, page 47.

COURSES OF STUDY

Preparatory Year

The courses of study in the preparatory year are designed for students who are not sufficiently equipped to take up the first year work of the regular courses. Students who have satisfactorily completed these subjects elsewhere will not be required to take them again, but may enter the first year at once.

Subjects:

Mathematics P	1
Mechanical Drawing P	10*
English P	180

*High School students who have covered most of the work, but who are deficient in Mechanical Drawing will be admitted to the regular courses under condition that the work in Mechanical Drawing be made up at some time during the first two years,—preferably during the first year.

Note: For hours of instruction see schedule of subjects on pages 8 and 9.

For descriptions of courses see pages 17 to 40.

COURSES OF STUDY

I. Chemistry and Chemical Engineering

Preparatory Year

See page 10

First Year

Mathematics I	2
Practical Physics	100
Inorganic Chemistry, Lectures and Recitations	40
Inorganic Chemistry, Laboratory	41

Second Year

Mathematics II	3
Qualitative Analysis, Lectures and Recitations	42
Qualitative Analysis, Laboratory	42

Third Year

Volumetric Analysis	43
Gravimetric Analysis	44
German I	185

Fourth Year

Organic Chemistry, Lectures	45
Organic Chemistry, Laboratory	45
Theoretical Chemistry I	47
German II	186

Fifth Year—For Chemical Engineering Students Only

Technical Analysis	46
Theoretical Chemistry II	48
Industrial Chemistry	49
Heat Engineering	80
Practical Electricity	60

Note: For hours of instruction see schedule of subjects on pages 8 and 9
For descriptions of courses see pages 17 to 40.

COURSES OF STUDY

II. Electrical Engineering

Preparatory Year

See page 10

First Year

Mathematics I	2
Practical Physics	100
Practical Electricity, Lectures and Recitations	60
Practical Electricity, Laboratory	61

Second Year

Mathematics II	3
Elements of Electrical Engineering, Direct Currents, Lectures and Recitations	62
Electrical Engineering, Laboratory, Direct Currents	63

Third Year

Elements of Electrical Engineering, Alternating Currents, Lectures and Recitations	64
Electrical Engineering, Laboratory, Alternating Currents	65
Technical Electrical Measurements	66
Technical Electrical Measurements, Laboratory	67
Hydraulic Motors	151
Heat Engineering	80

Fourth Year—To be omitted during 1915-1916

Advanced Alternating Currents	68
Electrical Engineering, Laboratory, Advanced	69
Electricity Supply Stations	70
Power Transmission	71
Electric Railways	72
Thesis	78

Note: For hours of instruction see schedule of subjects on pages 8 and 9.
For descriptions of courses see pages 17 to 40.

COURSES OF STUDY

III. Structural Engineering

Preparatory Year

See page 10

First Year

Mathematics I	2
Practical Physics	100
Advanced Mechanical Drawing and Orthographic Projections	11

Second Year

Mathematics II	3
Structural Mechanics	113
Structural Drawing	110

Third Year

Theory of Structures	114
Strength of Materials	115
Structural Design	111

Fourth Year—To be omitted during 1915-16

Advanced Structures	116
Bridge Design	112
Concrete Construction	117

Note: For hours of instruction see schedule of subjects on pages 8 and 9
For descriptions of courses see pages 17 to 40.

COURSES OF STUDY

IV. Railroad Engineering

Preparatory Year

See page 10

First Year

Mathematics I	2
Practical Physics	100
Advanced Mechanical Drawing and Orthographic Projections	11

Second Year

Mathematics II	3
Surveying and Plotting	131
Topographical Drawing	130
Highway Engineering	145

Third Year

Applied Mechanics	170
Materials of Construction	135
Concrete Construction	117

Fourth Year—To be omitted during 1915-16

Railroad Engineering	165
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Note: For hours of instruction see schedule of subjects on pages 8 and 9.
For descriptions of courses see pages 17 to 40.

COURSES OF STUDY

V. Municipal Engineering

Preparatory Year

See page 10

First Year

Mathematics I	2
Practical Physics	100
Advanced Mechanical Drawing and Orthographic Projections	11

Second Year

Mathematics II	3
Surveying and Plotting	131
Topographical Drawing	130
Highway Engineering	145

Third Year

Applied Mechanics	170
Materials of Construction	135
Concrete Construction	117

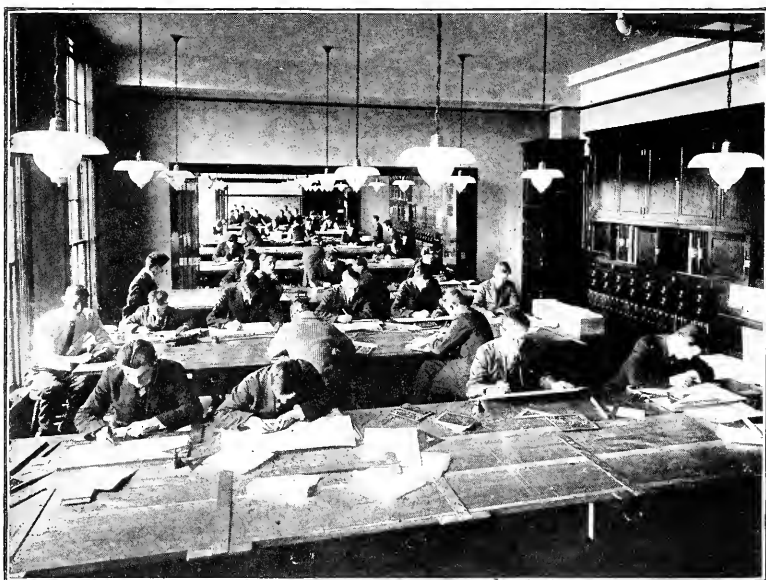
Fourth Year—To be omitted during 1915-16

Sanitary Engineering	155
Foundations	140
Hydraulic Engineering	150
Practical Electricity	60
Municipal Engineering Problems	160

Note: For hours of instruction see schedule of subjects on pages 8 and 9.
For descriptions of courses see pages 17 to 40.



REFERENCE LIBRARY



DRAFTING ROOM

DEPARTMENT OF MATHEMATICS

DIRECTOR: THOMAS E. PENARD, S.B.

INSTRUCTOR: MR. M. F. PINKHAM

The importance of mathematics as a means of mental discipline, and as a necessary basis for those intending to pursue engineering as a profession, cannot be overestimated.

Students taking the regular courses in Chemistry and Engineering are given two years instruction in applied mathematics, as outlined in Mathematics I and II. Special attention is called to these two courses in practical mathematics, which are intended to cover the field in so far as mathematics is ordinarily employed in the usual engineering computations. They are designed primarily for students taking the regular engineering courses, but may be taken to advantage by those regularly employed in engineering work who wish to obtain a more thorough grasp of applied mathematics.

Courses in advanced applied mathematics will be given provided a sufficient number of men apply to form a class.

1. Mathematics P.

Preparation: Arithmetic.

This course, of two periods per week during the preparatory year, is designed primarily for students taking the regular engineering courses; it is hoped, however, that it will be found adapted to the needs of others who wish to obtain a practical knowledge of elementary mathematics. The student is assumed to be thoroughly familiar with the fundamental operations of arithmetic. It includes:

Review arithmetic.

Algebra, including definitions and notation, fundamental operations, factoring, fractions, simple equations, powers and roots, ratio and proportion, variation, with applications to problems chosen from electricity and mechanics, formulas.

Geometry, including useful theorems relating to plane figures, measurements of triangle, polygons, circle, polyhedrons, cylinder, cone and sphere.

2. Mathematics I.

Preparation: Mathematics P (1), or equivalent.

This course of two periods per week during the first year, is a continuation of Mathematics I. It includes:

Review Algebra and Geometry.

Logarithms, the use of slide rules, discussion of precision and rules for significant figures.

Trigonometry including circular measure, co-ordinates, trigonometric ratios, formulas, law of sines, law of cosines, solution of right and oblique triangles, applications to problems in Physics and Engineering.

3. Mathematics II.

Preparation: Mathematics II (2), or equivalent.

This course of two periods per week during the second year is a continuation of Mathematics II. It includes:

Plotting of functions, interpolation, the straight line, curves represented by various equations, graphic solution of equations, determination of laws from the data of experiments, simplification of formulas.

Rate of increase differentiation, determination of maxima and minima by differentiation, integration, definite integrals, determination of mean value, area and volume by integration, centre of gravity, moment of inertia, partial differentiation.

Analytic Geometry and Calculus.

See Mathematics II

DEPARTMENT OF DRAWING

INSTRUCTORS: MR. JAMES BROUGH, MR. E. W. G. SMITH, MR. GEORGE A. TRUELSON, MR. W. F. WILLMANN

The courses in Mechanical and Architectural Drawing, as outlined, afford the essentials of drafting for those contemplating office work and are equally valuable and necessary to those working in the allied trades.

The art courses are varied and the work is thorough and complete, and of a high order. Great care is taken to develop

the student along the line of his natural inclinations, and, so far as possible, to have the work of the school bear directly upon his daily employment and other courses attended.

10. Mechanical Drawing P.

This course consists of work in the drawing room, occupying one evening a week throughout the entire first year. The drawing is of an elementary character, beginning with instruction in the use of instruments and the fundamental rules for executing engineering drawings. In conjunction with the drawing, the elementary principles of orthographic projections are studied, and the student prepares a number of plates illustrating the reproduction of objects in the shape of working drawings.

11. Advanced Mechanical Drawing and Orthographic Projections.

This course is a continuation of the work taken up during the preparatory year, see (4). It includes:

Problems on the point, line and plane; projections of solids; single and double curved surfaces and their intersections by oblique planes; and practical illustrations of the principles studied.

12. Machine Drawing.

The aim of the course is to teach the proper way of making the necessary dimensioned drawings for use in practice. The instruction includes: (a) The making of sketches of the parts of a machine from measurements; (b) the detail scale drawing from the sketches and a tracing; (c) an assembly drawing of the machine.

20. Architectural Drawing I. MR. TRUELSON.

An elementary course, including the fundamental principles underlying all kinds of mechanical and architectural drawing: geometrical problems; orthographic and isometric projections; classical mouldings; Roman alphabet, and roof problems.

In connection with this course the instructor will outline a course of reading in architectural history.

21. Architectural Drawing II. MR. TRUELSON.

The orders of Architecture. Practical architecture and details of construction. In this course the student is taught the component parts of buildings. Typical details of construction are drawn to a large scale and in isometric projection.

22. Architectural Drawing III. MR. TRUELSON.

This course covers the making of complete plans, elevations and working drawings of some elementary problem.

Special Students

Students desiring special work in Architectural Drawing, not outlined above, should consult with the instructor.

30 and 31. Freehand Drawing. MR. BROUGH.

Considering the great importance of the study of freehand drawing to all who are engaged in, or anticipate being engaged in any industrial art, artistic trade or profession, we offer a very complete course in this line, and call attention to the splendid advantages provided.

The work is adapted to the requirements of each individual student, so far as is practical and consistent with a thorough training in freehand drawing. There are two classes in both freehand drawing and industrial design.

9. Class I. The work of this class is intended to meet the wants of those students who have no previous knowledge of freehand drawing and is recommended to all students who intend to become craftsmen, designers, architects or artists, and also to others who may wish to take up the study as an accomplishment. The work will consist of drawing from typical models, by which students learn a sense of proportion and the principles of perspective; groups of still life for the study of composition and color; also drawing of historic ornament, and details of the human figure from the cast, by which students are taught to observe form, and the principles of light and shade.

10. Class II. The course of study in this class is of a more

advanced nature than that of Class I, and in addition to the more complicated forms of ornament, the full-length human figure from the antique is added, also rendering in pen and ink and pencil, advanced shading in charcoal, painting groups of still life in monochrome and polychrome, in oil and water colors.

35. Industrial Design and Interior Decoration. MR. BROUGH.

The courses in industrial design and interior decoration are specially helpful to those students who are already engaged in, or anticipate being engaged in such arts and crafts, as wood and stone carving, wrought and bent-iron work, brass and copper work, stained glass, furniture and drapery, interior decoration, book covers, wall paper, fabrics and other allied industrial arts, including lettering and commercial designing for advertising purposes. No limitation is placed upon the student who shows ability to take up the work prescribed for the class he wishes to enter, and students who so desire may spend part of their time in the freehand class and part in the industrial design and interior decoration class, without extra charge. The instructor is a certified art master and one of the leaders of the profession. Students in industrial design are recommended to take architecture.

Class I. The studies in this class include the work of the freehand drawing in Class I, with the addition of special studies given for the purpose of design, such as a systematic study of the various styles of historic ornament, studies of animal and plant form, and the elementary principles of design.

Class II. Students who have an elementary knowledge of drawing and design are considered eligible for this class and are taught the more advanced principles of composition, form and color in design, also rendering the same in various mediums, including charcoal, pencil, pen and ink, water and oil colors.

Our special library can be consulted by the students in these classes.

38. Life Class. MR. BROUGH.

At the repeated request of a number of advanced students we offer this class which will give an exceptional opportunity to students who wish to pursue their studies for the purpose of

acquiring a more perfect knowledge of the figure, and will be of great advantage to those who wish to become more proficient in this branch of art. At the present time the use of the figure is introduced into nearly every form of art work, not only in a purely artistic sense, but also in many forms of commercial work, and to be able to draw the figure well is a great achievement to the artist and designer.

Structural Drawing. See Dept. of Structural Engineering.

Topographical Drawing. “ “ “ “

DEPARTMENT OF CHEMISTRY AND CHEMICAL ENGINEERING

DIRECTOR: ELLWOOD B. SPEAR, A.B., PH.D.

INSTRUCTORS: EDWARD MUELLER, S.B., PH.D. AND ASSISTANTS

The wonderful advance in the application of science to the arts during the past few years has caused a great demand for technically trained men. Nearly every large manufacturing concern now employs chemists regularly, or else has experts whom it can consult at short notice. The scientific and technical schools are each year sending out large classes of young men, especially trained to meet this demand. For a young man to acquire this education requires four years at a scientific, or technical school, in addition to the four years necessary for preparation at the secondary school, and an outlay of from two to three thousand dollars. These necessary expenditures of time and money are such that many young men, who are mentally capable of taking such courses, are obliged to give up their ambitions and fill inferior positions.

Formerly the practical knowledge which young men acquired by contact with their work was sufficient, but today the degree of specialization is such that a theoretical knowledge is essential to success in many industries where chemical processes are utilized.

There are many men who, by close application to the practical side, have acquired responsible positions in technical industries, but are unfamiliar with the theoretical side of their chosen work.

Such men are unable to advance in their special lines, because they cannot read the many valuable books written on special technical subjects, which presuppose a general knowledge of the theory of chemistry.

At the present time, the requirements of admission to the higher institutions of learning, even for special students, are such that the doors are practically closed to these men, although many of them could take special courses with profit. Again the only available hours for such men are during the evening. There is a demand, therefore, for a systematic evening course in chemistry, which will be open to men engaged at the present time in technical industries.

Regular Students

The school offers a thorough four-year course in the general principles and applications of inorganic, organic and analytical chemistry, sufficiently complete to enable students to pursue their work with intelligence; to correlate theory and practice; to read technical works with profit; to test the quality and purity of chemicals and to become familiar with the laboratory methods of the trained chemist.

To the student who can pursue his studies an extra year, and who has had the necessary training, the school offers a course in chemical engineering. It is the aim of this course to prepare men to aid in the operation of industries based on chemical principles.

Special Students

Any of the courses in chemistry may be taken singly, provided the head of the department is satisfied that the student can pursue the work with profit.

Special courses may be arranged with the head of the department.

Students are especially urged to take the entire work on the schedule of each year. A good grounding in mathematics, physics and German is essential to success in the chemical subjects of the third and fourth years.

Laboratories

The laboratories in the new building on Huntington Avenue are fitted with an excellent equipment in up-to-date apparatus, to give thorough instruction in all the courses offered.

A laboratory deposit of three dollars for the first year, and four dollars for all other years, must be paid before desks will be assigned. Students who have not checked up their desks by the end of the school year will be charged one dollar extra.

Owing to the increased prices of all materials used in the chemical laboratories, due to war conditions, a laboratory fee of two dollars will be charged to each student taking courses in the chemical laboratories.

The School makes an effort to secure positions for those who have successfully completed the course in chemistry, or chemical engineering.

40. Inorganic Chemistry. DR. SPEAR AND ASSISTANT.

A course of fifty-six experimental lectures on the fundamental laws and principles of inorganic chemistry. The course aims to familiarize the student with the properties and preparation of the following elements and their most important compounds:—oxygen, hydrogen, the halogens, sulfur, nitrogen, phosphorus, carbon, silicon, the alkali and alkaline earth groups, iron and aluminum. The course is to be taken in conjunction with (41).

Text book:

General Chemistry for Colleges, Smith.

41. Inorganic Chemistry Laboratory. DR. SPEAR AND ASSISTANT.

A laboratory course of 28 weeks, 90 periods in which the student is expected to verify and illustrate the facts and principles that have been discussed in the lectures. To be taken in conjunction with (40).

Text book:

Laboratory Experiments in Inorganic Chemistry, Spear.

Courses (40) and (41) are well adapted to the needs of those who wish to take the College Entrance examinations.

42. Qualitative Analysis. DR. SPEAR AND MR. STRAHAN.

Preparation (40) and (41), or an equivalent.

A practical course in qualitative analysis of 28 weeks, 140 periods duration, in the second year. The course relates to the identification of the common metallic elements and the ordinary acids.

Each student is expected to make complete and accurate analyses of various mixtures, alloys and chemicals used in the industries. The laboratory work is supplemented by lectures and conferences.

Text books:

General Chemistry for Colleges, Smith.

Qualitative Chemical Analysis, A. A. Noyes.

43. Volumetric Analysis. DR. MUELLER AND ASSISTANT.

Preparation, (40), (41), (42) or equivalent.

A course of 14 weeks, 98 periods, in the third year on volumetric determinations, involving the use and the standardization of burettes, pipettes and measuring flasks. The course includes alkalimetry, acidemetry, indicators, oxidimetry, iodimetry, chlorimetry. The laboratory work is supplemented by lectures and conferences.

Text book:

Quantitative Chemical Analysis, Talbot.

44. Gravimetric Analysis. DR. MUELLER AND ASSISTANT.

Preparation, (40), (41), (42), (43) or equivalent.

A course of 14 weeks, 98 periods, devoted to the principles and practice of gravimetric analysis. The laboratory work is supplemented by lectures and conferences.

Text books:

Quantitative Chemical Analysis, Talbot.

Analytical Chemistry, Treadwell and Hall, Vol. 2.

45. Organic Chemistry. DR. MUELLER AND ASSISTANT.

Preparation, (40), (41), (42), (43), (44).

A course consisting of 196 periods during the fourth year. The course is devoted to lectures, conferences and laboratory work, on the principles of organic chemistry, as illustrated by

the methane and benzene derivatives. The student is required to prepare in the laboratory a number of organic compounds, selected to show the characteristic reactions, and to give training in the practical separation and purification of organic substances. After this synthetic work, the students are given a practical course in organic analysis.

Text books:

Holleman, Text-book of Organic Chemistry; Gatterman, Practical Methods in Organic Chemistry, translation by Schober. Laboratory notes by the instructor.

46. Technical Analysis. DR. MUELLER AND ASSISTANT.

Preparation, (45) or an equivalent.

A course of 28 periods in the fifth year, on the following:

Analysis of gases.

Analysis and testing of mineral, animal and vegetable oils.

The origin, manufacture, properties, uses and analysis of the various fuels, and the determination of the heat value of fuels by the use of a calorimetric bomb.

47 and 48. Theoretical Chemistry I and II. DR. SPEAR, DR. MUELLER.

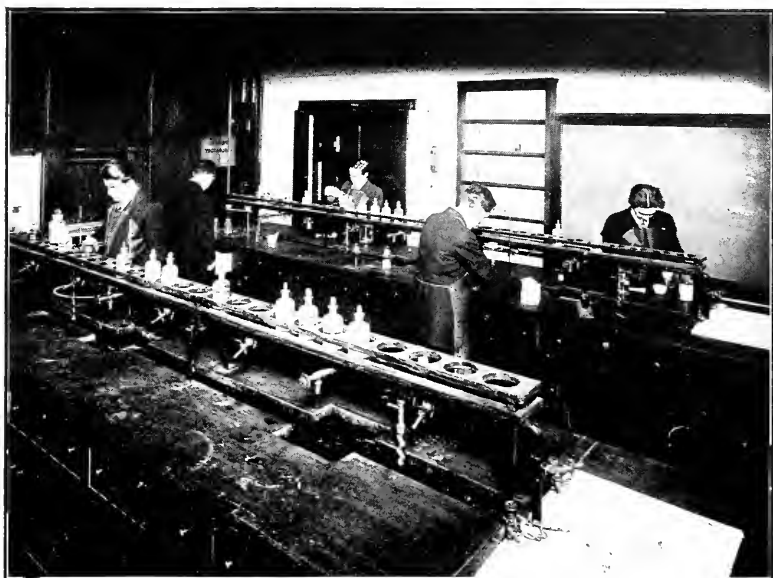
Preparation, (3), (42), (43), (44).

A course of 56 lectures and conferences on chemical equilibrium and electro-chemical topics. The course will include lecture experiments and discussion of problems on the law of mass action applied to the rate and equilibrium of chemical reactions, the effect of temperature and pressure, the conduction of electricity by solutions, the production of electricity by chemical change, the electromotive force of voltaic cells and single potential differences. Problems for independent solution by the student will also be given.

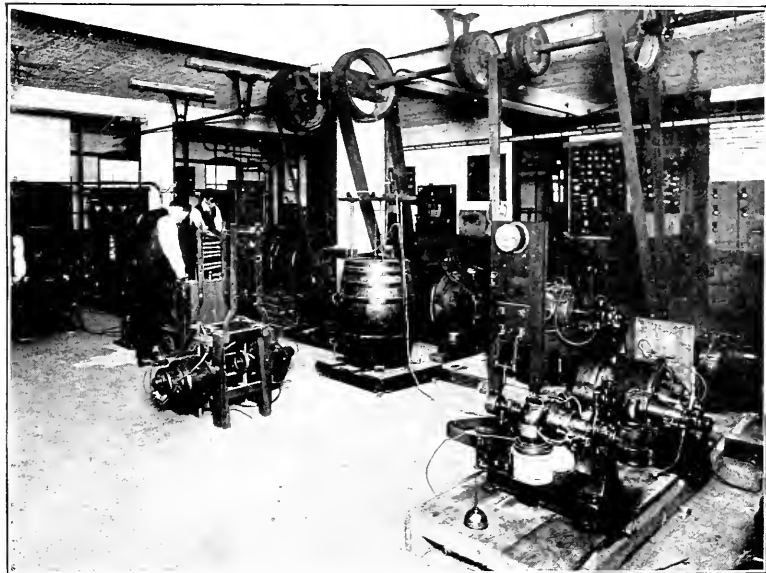
49. Industrial Chemistry.

Preparation, (42), (43), (44), (45).

A course of 28 lectures and conferences on the more important chemical processes. Attention is given to many operations of a general nature common to chemical industries, such as crushing, grinding, filtration, evaporation, distillation, etc.,



CHEMISTRY LABORATORY
(One of Three)



CORNER OF ELECTRICAL LABORATORY

and to the apparatus employed in these processes. Some of the more important industries will be taken up in detail.

Text Book:

Thorp, Outlines of Industrial Chemistry.

DEPARTMENT OF ELECTRICAL ENGINEERING

DIRECTOR: O. R. SCHURIG, S.B.

INSTRUCTORS: LOREN N. DOWNS, JR., S.B., A. L. GARDNER, S.B., MR. F. G. HARTWELL, MR. R. E. SMITH

The course in electrical engineering is intended primarily to cover the needs of two classes of men: (1) men who are working in the electrical trades, or other mechanical trades involving the use of electricity, who desire to increase their knowledge of practical electricity and to gain a thorough understanding of the electrical engineering principles and their broader application, such as to prepare them for positions of foremen, superintendents, or operating managers in their particular field; (2) young men in business possessing a good general education, who wish to gain a knowledge of the technical matters of electricity, together with a sufficiently broad conception of the theories underlying all electrical engineering work, in order to render themselves more useful in their line of business by the combined general and technical training.

The ideal condition for laying out a single course to serve the variety of needs represented by the individual interests of the students, would obviously be exact equality of preparation for all students beginning the work of the first year. Though such equality cannot be expected of all the men entering the first year, there must be a certain general basis of preparation, in order that the work may be of the greatest benefit to the largest number of men; therefore, the work of the first year has been laid out in such a way as to be of no special difficulty to those with a high school training or the equivalent thereof; at the same time, certain men who have not had such preparation, but whose experience in practical life has sufficiently matured them, should be able to enter the first year with success, though they may be required to make up some of the preparatory work, while they may be excused from certain portions of the practical work with which their experience may have

brought them into contact. It is recommended that such men should consult with the Dean or the Director in arranging their schedule. In general, a man entering the first year should (1) have easy command of the English language, such as to enable him to express himself and write clearly, (2) be familiar with elementary mathematics and algebra, (3) know the fundamentals of mechanical drawing.

In order to accommodate students who are lacking in these preparatory matters, a preparatory year is given (see p. 10), the work of which may be required, as a whole or in part, of those with deficiencies.

Men with advanced training and experience will be admitted to the second or third year, in accordance with their preparation. Such men should not only study the program presented below, but should submit their case to the Dean or Director.

Students are invited to avail themselves of consultations with the various instructors, whenever desirable.

60. Practical Electricity.

First Year—Two classroom exercises per week for 28 weeks.

This course of lectures and problem work covers the following practical subjects.

1. Simple electrical apparatus such as annunciators, burglar alarms, gas-lighting systems, arc and incandescent lamps; the wiring of such apparatus, together with a thorough discussion of electric-wiring devices; moulding, conduit, knob, tube and cleat work; methods employed in wiring old and new houses.

2. Different types of d-c. motors and generators, and devices for their control; methods of installing and connecting motors and generators, and their complete circuit; practical operation of d-c. motors and generators; their troubles, causes thereof and remedies therefor; switchboard wiring and switchboard devices for direct current, both for two- and three-wire systems; boosters and balancer sets and their use.

It is not intended to cover in this course the details of large generating stations and complex distribution systems with complicated apparatus and special devices, but rather

those of small installations as applicable to small private plants and to the average central-station consumer. In all this work special emphasis is placed on the rules embodied in the *National Electric Code* and on the best methods of modern practice.

In the course of the work, reference is made to such principles of electrical engineering as are necessary to give a clear understanding of the subject under consideration, and, in that respect, this course serves as a definite preparation leading up to the second-year course on Elements of Electrical Engineering.

61. Practical Electricity Laboratory.

First Year—One entire evening each week for 28 weeks.

This laboratory course is to be taken simultaneously with the lecture course on Practical Electricity. The experiments cover the subjects treated under Practical Electricity.

62. Elements of Electrical Engineering, Direct Currents.

Second Year—Two 1½-hour periods per week for 28 weeks.

This course of lectures, recitations and problem work is devoted to the study of the laws and properties of electric and magnetic circuits, and of the principles and operation of direct-current machinery, and of direct-current practice.

The following topics are considered:

General principles of magnetism, the magnetic circuit.

The electric circuit, Ohm's law, Kirchhoff's law, units of resistance, current and potential.

Electromagnetic induction, the dynamo.

Direct-current generators and motors, their construction, operation and applications.

Direct-current systems, generation and distribution of power, storage batteries.

Electric lighting and photometry.

A great variety of problems based on practical engineering conditions are solved, both in class and outside, by the students.

63. Electrical Engineering Laboratory, Direct Currents.

Second Year—One entire evening each week for 28 weeks.

The experiments performed in this course are intended to supplement the class-room work of the course on Elements of Electrical Engineering. The first experiments cover Ohm's

law, Kirchhoff's law and Faraday's law. In the subsequent work, the characteristics of d-c. generators and motors are determined experimentally; efficiency, losses, regulation, heating are carefully studied in the laboratory. Each student is required to furnish a complete report, including theory, method of procedure, results and conclusions, on each experiment performed by him.

64. Elements of Electrical Engineering, Alternating Currents.

Third Year—One 1½-hour period per week for 28 weeks.

This course of lectures, recitations and problem work, covers the principles of electrostatics, the theory of variable currents in the simple series circuit containing resistance, inductance and capacity, the general theory of harmonic alternating currents, single-phase and polyphase circuits, non-sinusoidal currents and voltages. The last part of the course deals with the alternator, its regulation and efficiency, the transformer, its ratio, regulation, efficiency and application. The problems illustrating the various principles are taken, whenever possible, from the field of practical engineering.

65. Electrical Engineering Laboratory, Alternating Currents.

Third Year—Five evenings during last third of year.

A series of 5 laboratory exercises in the latter part of the third year are devoted to the experimental study of a-c. circuits, the alternator and the transformer, supplementing the corresponding classroom work.

66. Technical Electrical Measurements.

Third Year—One hour per week for 28 weeks.

In this course of lectures and recitations the theory, construction and operation of the more common types of measuring instruments are studied, together with the various methods of measurements employed in modern engineering practice. Emphasis is placed upon the useful field of application, as well as on the specific practical limitations of each instrument or testing process.

67. Technical Electrical Measurements, Laboratory.

Third Year—One evening per week in the first two thirds of the year, five exercises during the last third of the year.

The experiments carried on by the students in this course illustrate the use of the instruments and the testing methods studied in the course on "Technical Electrical Measurements," as well as the principles covered in the lectures on "Elements of Electrical Engineering; Alternating Currents." Each experiment is to be covered in a comprehensive report submitted by each student.

68. Advanced Alternating Currents.

Fourth Year—One hour per week for 28 weeks.

This course of lectures, recitations and problem work is devoted to the detailed study of the common types of a-c. machines, together with their application to large systems. Some of the general considerations concerning long-distance transmission are also discussed.

69. Electrical Engineering Laboratory, Advanced.

Fourth Year—One evening per week for 28 weeks.

In this course the work of the third-year course in Electrical Engineering Laboratory is continued. The more complicated types of a-c. machines are tested, and power-plant tests of the Y. M. C. A. electric plant are made. Complete reports are required on each test performed, as in the second and third-year laboratory courses.

70. Electricity Supply Stations.

Fourth Year—One exercise per week for 28 weeks.

This course deals with the layout, construction and operation of electric power generating stations, substations and distribution systems. Emphasis is placed upon the characteristics, both technically and economically, of each type of station, steam-power-operated, water-wheel-driven and internal-combustion-motor-operated. The various rate systems and their specific fields of merit will also be discussed.

71. Power Transmission.

Fourth Year—One 1½-hour exercise per week for 14 weeks.

In this course are considered the economic problem of power transmission, the principles governing the design and the construction of transmission lines, and some of the more important legal requirements.

72. Electric Railways.

Fourth Year—One $1\frac{1}{2}$ -hour period per week for 14 weeks.

This course includes the following subjects: Train resistance, characteristics of railway motors, design of motor equipment, electric locomotives, design of power generating and distribution system for electric railways; also such details as car construction, rails, bonding, trolley and third-rail construction. The subjects of storage-battery traction, and steam-railroad electrification are also briefly discussed.

73. Thesis.

During the final year, each student in order to qualify for a diploma, must prepare and present a report upon some piece of original work, investigation of some piece of machinery, consideration of some practical problem, or similar subject, the students working either alone or in pairs, and at such time as they please, within limits, the subjects being selected in consultation with one of the instructors, who will have immediate supervision of the work.

The object of this work is to develop the student's powers of original investigation and to teach the principles upon which the study of special problems of various kinds should be approached. It is hardly expected that the immediate results of the investigation will be of great value, in view of the time allowable, considered as contributions to engineering knowledge, but it is expected and believed that the value to the student himself will be very great.

80. Heat Engineering: Thermodynamics and Boilers.

A course of 28 hours in the study of the principles of thermodynamics; a discussion of the properties of gases, saturated and superheated vapors, especially of air and steam; of the flow of fluids through orifices, nozzles, pipes and meters, a discussion of the action of the steam injector; a study of the various cycles of the hot air, internal combustion and steam engines of the turbine, air compressor and refrigerator systems. These engineering applications are treated from the physical, analytical and graphical points of view, so as to give the student a good foundation in the principles of thermodynamics, in the solution of actual heat engineering problems. The course also includes

a study of the simple, compound and multiple expansion steam engine, of the different types of gas engines, of the gas producer, of compressed air and refrigerator machines, and the methods of testing such machines.

The latter part of the course includes a study of the various types of steam boilers and the different kinds of power plant apparatus, including fans, blowers, economizers, condensers, feed pumps, etc. A short discussion of the construction and stability of chimneys is also given.

DEPARTMENT OF STRUCTURAL ENGINEERING

DIRECTOR: C. S. ELL, M.S.

INSTRUCTORS: H. H. AMBLER, S.B., C. A. FARWELL, S.B.

The four years' course in structural engineering covers thorough instruction in mathematics, mechanics and the theory and practice of drafting, detailing, estimating and designing. Thorough instruction is given by means of lectures and classroom work in the important theoretical and practical principles of design, supplemented by the execution of detail drawings in the drafting room.

100. Practical Physics.

This course consists of two lectures per week, on Monday and Friday evenings, throughout the year. Instruction is given in the practical application of physical laws. Each lecture, as far as possible, is accompanied by practical tests in the lecture room on large size apparatus, built especially for this course, so that the student may actually see a demonstration of the truth of the various laws, thus enabling him to grasp readily the underlying principles. The course is devoted to a study of the mechanics of solids, liquids and gases, heat and its effects, together with lectures on light and sound. Practical problems covering each phase of the work are given throughout the year which are designed to fix in the student's mind the fundamental principles taken up in the lectures. The supplies for this course are a set of notes on "Practical Physics" prepared by C. S. Ell, a pair of small 4 or 5 inch triangles and a 4-inch cardboard protractor.

110. Structural Drawing.

The course in structural drawing occupies one evening a week throughout the entire second year. The course consists in the working out of various graphical problems of mechanics on the drawing board, drawing standard sections of structural steel shapes, structural details and the preparation of drawings, representing simple structures. The purpose of this course is to familiarize the student with detailed drawings and teach him where and how to dimension structural parts on working drawings.

111. Structural Design.

The course in structural design consists of work in the drawing room, one complete evening each week throughout the third year. It is a continuation of the course in structural drawing given in the second year, and includes the execution of elementary structural design, taking up in a practical way the principles given in the course in Theory of Structures. Each student is given data for various problems, the designs for which he works out in the drawing-room, making all necessary computations and executing all drawings necessary for the preparation of a complete design of a number of engineering structures.

112. Bridge Design.

The course in bridge design occupies one complete evening a week throughout the fourth year. Most of the work is done in the drawing room, but instruction is given from time to time by means of lectures. The work includes the execution of complete designs for several types of railroad bridges and the execution of complete working drawings.

113. Structural Mechanics.

This course consists of one period on Monday and Friday evenings, throughout the second year. The course covers the fundamental principles of statics, the computation of shear and moment diagrams, a study of the centre of gravity and the moment of inertia of plane figures and the application of the various principles of mechanics to the solution of simple structural problems. The work consists of lectures, recitations and the solution of problems, many of which are done in the drawing room.

114. Theory of Structures.

This course occupies one period on Monday and Friday evenings throughout the third year and consists of lectures, recitations and solution of problems. In this course instruction is given in the fundamental theory of structures including the theory of beams, computation of reactions, moments, shears for static and moving loads. The work in the class-room is supplemented by the solution of many practical problems in the drawing room.

115. Strength of Materials.

This course occupies one period on Monday and Friday evenings throughout the third year, consisting of lectures, recitations and the solution of problems. Instruction is given in the properties of various building materials, such as stress, strain and the various elastic properties of the different materials. Study is also made of the strength, composition and adaptability of steel, timber, stone, concrete and various other materials for use in structures.

The common theory of beams is also studied with a thorough discussion of the distribution of stress, shearing forces, bending moments, slopes and deflections.

116. Advanced Structures.

This course occupies one period on Monday and Friday evenings, throughout the fourth year. It is a continuation of the theory of structures given in the third year and takes up the fundamental principles involved in the design of various engineering structures, such as buildings, bridges, retaining walls, arches and other structures, as the time permits. Instruction is given by means of lectures and recitations and the various theoretical principles are applied in the execution of practical designs in the drawing room.

117. Concrete Construction.

This course occupies one period on Monday and Friday evenings throughout the fourth year. The various principles of design of structures of reinforced concrete are taken up by means of lectures. Instruction is given in the theory and practice of reinforced concrete construction and the student

solves many problems illustrating the computations for design of beams, girders, floor slabs, columns, footings, retaining walls, etc. Some of these problems are worked out and drawings are made in the drawing room.

DEPARTMENT OF RAILROAD ENGINEERING AND MUNICIPAL ENGINEERING

INSTRUCTORS: JOHN W. HOWARD, S.B., CHARLES H. RESTALL, S.B.

The school offers a complete course in Municipal Engineering to meet an urgent demand for instruction in this Department. The course, extending over a period of four years, has been prepared with great care and it is believed will meet the requirements of those who wish to equip themselves for Town or City Engineers.

Students wishing to take separate courses may do so on approval of the Dean.

130. Topographical Drawing.

This course of 28 weeks in the second year is primarily designed to give training in the interpretation and drawing of topographical maps. It consists of one and one-half hours per week in the drawing room, devoted to the study of the different conventional signs employed, and each student is required to make a number of plates and to become reasonably proficient in the preparation of such maps. Particular attention is given to the study of contour maps, and the solution of problems relating thereto.

131. Surveying and Plotting. MR. HOWARD.

Preparation: Trigonometry or Mathematics II (2).

The course in surveying consists of 3 hours instruction each week during the second year, in the theory of plane surveying, with field exercises on Saturday afternoons in the Fall and Spring.

During the first term the field work consists of practice in the use of the transit and tape in making surveys for determining areas and for making plans. The class work includes methods of computing areas, subdividing land, and all of the common problems of plane surveying,

The second term is devoted chiefly to drawing. Students are required to plot a survey of a city lot on a scale of 40 feet to an inch, to draw a plate of conventional signs used in topography, and to plot a topographical map on a scale of 100 or 200 feet to an inch.

In the spring the field work consists of practice in using the level for establishing bench marks, running profiles, cross sectioning, etc. The class work includes problems in the use of contour maps, plotting profiles, estimates of earthwork, etc. If time permits, instruction is given in stadia and plane table surveying.

135. Materials of Construction.

A course of one and one-half hours per week during the third year, taking up a consideration of the properties of the various materials used in engineering construction, such as wood, iron, steel, brick, stone, cement and concrete.

140. Foundations.

A course of one hour per week during the last eight weeks of the fourth year.

The subjects treated in this course are as follows: Building stones and concrete, bearing power of different kinds of soil, examination of the site, designing the footings, whether of masonry, or of steel and concrete, independent piers, pile foundations, compressed air processes, freezing processes, retaining walls, together with some details of buildings for industrial purposes, constructed of steel or of reinforced concrete.

145. Highway Engineering.

A course of one hour per week throughout the second year, in which are treated the following subjects:

The construction of roads and city streets, the problems of drainage and maintenance, qualities of trap rocks, good gravel, binding materials, paving blocks and bricks, concrete foundations, and the uses of asphaltic oils and other bituminous materials.

150. Hydraulic Engineering.

A course of one and one-half hours per week during the fourth year. The course consists of two parts. The first is

devoted to the study of theoretical hydraulics dealing with hydrostatic and hydrodynamic pressure, the flow of water through channels, pipes, orifices and nozzles and over weirs. The second part deals with such practical problems as the study of stream flow and storage and the development of water power.

151. Hydraulic Motors.

A course of one and one-half hours per week, mainly recitations covering the principles of hydrostatic and hydrodynamic pressure, the flow of water through open channels, pipes, orifices and nozzles and over weirs. Half the time is given to a study of impulse wheels and reaction turbines, with reference to their proper construction, regulation and testing, and to the various sources of loss of energy in their operation.

155. Sanitary Engineering.

A course of 65 hours during the fourth year, consisting of the study of water supply and sewage disposal and their relation to public health, the sources of water supply, tests for purity, bacteria, etc., the design of a sewage disposal system, septic tanks, filter beds, and the collection and disposal of garbage wastes.

160. Municipal Engineering Problems.

A course of 28 weeks in the fourth year dealing with various engineering problems encountered by town and city engineers such as construction of sewers, retaining walls, bridges, grade crossing problems, making of contracts and writing specifications for various construction work, methods of inspection and handling of public service properties, such as poles, lines, conduits, tracks, etc.

165. Railroad Engineering. MR. RESTALL.

A course of 3 evenings per week during the fourth year. It includes the study of the following:

Railroad location, as influenced by topographical features, purpose, grades, pusher grades, length of line curvature, rise and fall. Field work and making of location plans.

Computation and methods of laying out of simple, compound, reverse and easement curves. Circular and parabolic

curves in connection with gradients. Practical curve problems.

Earthwork, slope stakes, cross sections, burrow pits, methods of computations, tables and diagrams.

Frogs, switches, turnouts, cross-overs, crossing frogs, turnout tables, track, track laying, rail, ballast and drainage.

Yard design, passenger and freight yards, gravity yards, hump yards, yard accessories, stations, terminals, elimination of grade crossings, methods of construction and making estimates.

Draughting. The course will be supplemented to some extent by draughting and by railroad designing.

Fieldwork. Where necessary to illustrate the principles involved in the course, exercises will be given in the field on Saturday afternoons in the spring.

Preparation. Algebra, geometry, trigonometry, surveying.

If not qualified by having passed the above subjects, a student may be admitted as a special student on approval of the instructor of the course with the consent of the dean.

170. Applied Mechanics.

This course of 70 hours comprises a study of general methods and applications of statics, including the determination of stresses in frames; of centre of gravity, moment of inertia and radius of gyration; of kinematics and dynamics including uniform and varying rectilinear and curvilinear motion, centrifugal force, momentum, impact, work, power and kinetic energy.

DEPARTMENT OF LANGUAGES

180. English P.

A course of two hours per week throughout the preparatory year, taking up the principles of composition, special attention being given to spelling, punctuation and grammar. The object of the work is to enable the student to express himself clearly, forcibly and properly.

185 and 186. German I and II.

These courses of one hour per week throughout the third and fourth years respectively, are planned to give the student a knowledge of German grammar as well as a working vocabulary of scientific terms.

Equipment

The School is now housed in the new building of the Association, and has very exceptionally equipped quarters for carrying on the work of the Engineering Courses.

MECHANICAL DEPARTMENT

Mechanical Laboratories.

Our own steam engineering plant is completely equipped with meters, scales, indicators and all the necessary accessory equipment for making complete boiler tests, and determining the efficiencies of the various appliances used in generating power, heat and light for our new building. This places at the disposal of our classes a perfectly equipped, up-to-date, engineering department, and gives them the means of carrying on boiler tests, determining the efficiencies of various fuels and oils, taking indicator diagrams, determining the efficiency of modern reciprocating engines and turbines when direct connected to generators, as well as renders them familiar with all the various auxiliary appliances of such a plant, as condensers, pumps, air compressors, etc. The students also have the use of the equipment of our Automobile School, thus giving opportunity to study the most advanced ideas in gasoline engine practice.

MECHANIC ARTS LABORATORIES

There are at present two laboratories, one for metal work and the other for wood working and pattern work, which are available for the use of our students.

The metal working laboratory is well equipped, and affords the student an opportunity for work with various machines, as: lathes, shapers, drill presses and milling machines. There are also a gas forge and brazing furnace, together with all the required equipment for bench work instruction.

The wood working laboratory has a power band saw, lathes, circular saw, buzz planer and all the necessary equipment for wood working and pattern work.

In addition to the foregoing, a small but completely equipped shop for the construction and repair of apparatus and for the use of students in connection with their thesis work

has been installed. This shop is equipped with a metal and wood working lathe, grinder and all the necessary wood and metal working tools. There is also a very complete set of cabinet worker's tools for use in wood working.

CIVIL ENGINEERING DEPARTMENT

Field Instruments.

For work in the field the Department possesses various surveying instruments, representing the principal makes and types of instruments in general use. The equipment includes transits, levels, compasses, a complete plane table outfit, Locke hand level, flag poles, leveling rods, stadia rod, engineers' and surveyors' chains, steel and cloth tapes and other accessories. For Higher Surveying, an Aneroid Barometer is used for barometric leveling, and the transits are equipped with neutral glasses and reflectors for astronomical observations, as well as a sextant, reading to ten seconds, and equipped with neutral glasses and telescopes. This year a Buff and Buff No. 1 Engineer's Transit has been added to the equipment.

The scope of the equipment and the fieldwork itself are designed to train the student's judgment as to the relative merits of the various types of field instruments.

Design and Drafting Rooms.

The School possesses large, light and well equipped drawing rooms for the carrying on of the designing and drafting, which form so important a part of civil engineering work. These rooms are supplied with lockers containing the drawing supplies, and files containing blue prints and photographs of structures that represent the best practice. Many of the prints and photographs are of structures erected in and about Boston.

ELECTRICAL ENGINEERING DEPARTMENT

The Electrical Laboratory is well equipped with apparatus for teaching the principles of measurements, and the equipment is being steadily increased and developed for the doing of work of a higher degree of precision. Among the special pieces of apparatus may be mentioned the following: Cary Foster Bridge, a modified form of Hoopes Conductivity Bridge, a Laboratory

Wheatstone Bridge, a Leeds Northrup Potentiometer with Volt box, standard cells and low resistance standards, an accurate Chemical Balance and other appliances for the close determination of currents, resistances and potential differences.

There was added last year a set of variable inductances, and a set of condensers to the amount of eighty microfarads capacity variable in steps of one-tenth microfarad each.

Among the instruments for testing purposes, for alternating current work, may be mentioned the following: Three matched voltmeters and three General Electric Type P-3 Iron clad wattmeters arranged for Y connection, one G. E. Polyphase Wattmeter with double current and potential ranges, numerous other voltmeters of various ranges, potential transformers, numerous ammeters some with current transformers, three integrating meters, one General Electric and one Westinghouse polyphase, switchboard type, integrating wattmeters and a High Torque General Electric test meter. There is also a considerable and increasing assortment of auxiliary testing apparatus, such as synchronism indicators, power factor indicators, frequency indicators, etc.

For direct current testing, there is a large and increasing collection of Weston instruments, both voltmeters and ammeters, of suitable ranges and grades of precision, while the measurement of unusual currents and voltages is ensured by three Weston millivoltmeters with an assortment of standard shunts and multiplying resistances of various orders of magnitude.

For calibrating purposes, a 120 ampere-hour storage battery has been added to the equipment for current tests, while for voltage work, there is a 260 volt potential battery.

There is also the usual assortment of testing devices, such as speed indicators, tachometers, brakes, loading resistances and the numerous minor pieces of apparatus needed in practical testing and operating of electrical machinery.

Among the machines of this Department, are a pair of specially made, matched machines arranged to run as single phase, two or three phase generators, or motors, as well as synchronous transformers, double current generators, or on the Direct Current side as shunt, series or compound, generators, either two or three wire, or as motors.

There are also a 15 horse power 230-volt Westinghouse motor, a new General Electric 10 horse power Interpole 230-volt motor, a 500-volt generator, two 500-volt series and several 500-volt shunt motors, and a series parallel controller.

A 45 K. V. A., 60-cycle, single phase, 500-volt generator giving a practically pure sine wave, three General Electric Type H transformers, each of 3 K. V. A. capacity, a 7 1-2 K. V. A. special General Electric 60-cycle 230-volt alternator, with revolving field tapped for either 1, 2, 3 (star or mesh connection) 6 or 12 phase connection, which may be operated also as a synchronous motor.

During the past year there have been added a 5 H. P. G. E. single phase induction motor, which may also be operated as a three phase motor and a 10 H. P. Fort Wayne shunt motor driving a special Holtzer-Cabot 3 phase 5 K. V. A. Alternating Current Generator. This latter machine has two special rotors, permitting its use as a squirrel cage or phase wound induction motor. A three phase regulating resistance for use with the phase wound rotor, has also just been installed.

There is also available for advanced instruction, in co-operation with the Mechanical Department, the four three-wire generators (two driven by reciprocating engines and two by Westinghouse-Parsons turbines) in the main generating plant of the Association.

DEPARTMENT OF PHYSICS

There is a large laboratory devoted entirely to Physics together with a lecture room.

The Physics Department has been very completely equipped with all necessary apparatus for the experimental work that is required of the students, as well as that required for lecture demonstration. Among other things have been added: verniers, levels, spherometers, calorimeters, thermometers, pyrometers, a spectroscope, a microscope, a spectrometer, balances, standard gram weight, lecture table galvanometer, optical disk with all accessories, lenses, photometer, a full set of Weather Bureau apparatus, including a barograph, thermograph, hygrometer, barometer, maximum and minimum thermometers, etc. These, in addition to the equipment already owned, give a wide range to the experimental work that can be done.

DEPARTMENT OF CHEMISTRY

This Department is completely equipped in all respects for carrying on all lines of Chemical work, from that of a High School to that of most advanced College grade. The three laboratories, with accommodations for over one hundred and fifty students, are very exceptionally furnished with all the necessary appliances for chemical work. Some of these are: hoods, drying closets, still, steam and hot water baths, electrolytic circuits, vacuum and pressure apparatus, balances, combustion furnaces, complete sets of apparatus for the sampling and analysis of flue gases and fuels. There are also testing machines for oils, viscosimeters and different sorts of flash point apparatus. A chemical museum is connected with this Department where are kept specimens for purposes of illustration.

LIBRARIES

There is in connection with the School a professional library containing books pertaining to both the school work of the boys and to their practical work. In addition to this there also are current periodicals on engineering and scientific subjects for their exclusive use. All members of the School are entitled to take books from the Boston Public Library, and this offers a very unusual opportunity to our non-resident students.

DEPARTMENT OF PHYSICAL TRAINING

Our new gymnasium with all the latest modern equipment gives ample accommodation for all students.

There is a running track on the grounds adjoining, together with tennis and hand ball courts; also a large natatorium where swimming is taught by competent instructors.

In connection with this Department, there are also six excellent bowling alleys, which may be used by the students upon the payment of a nominal fee.

RESTAURANT AND BARBERSHOP

Attention is called to the fact that there is a spa on the first floor and restaurant in the basement of the Association building. There is also a barber shop in the basement.

For all further information, write

The Evening Polytechnic School,
316 Huntington Ave., Boston, Mass.

Additional Information

The School reserves the right to retain for its annual exhibition, and for any other purpose which it may deem necessary, drawings made by students.

Scholarships.

As an aid to worthy men who desire an education and are unable to pay in full even our slight charges, a limited number of scholarships have been provided, which will be judiciously distributed by the Educational Committee, to whom application should be made.

Entrance Requirements.

Any man of good character, regardless of age, occupation or creed, with adequate general education may be enrolled in the School.

A student may elect any subject, or combination of subjects, which best serves his particular needs. However, to prevent loss of time and expense to the student, he will not be allowed to elect courses which, on account of inadequate preliminary training and experience, he could not pursue with profit. The Dean should be consulted before registration.

Certificates.

Upon the satisfactory completion of any of the regular, or special courses, the student is entitled to receive a certificate. No certificates will be given, however, unless the student has successfully performed the prescribed work and passed the necessary examinations.

Suburban Members.

All tickets held by members of the Cambridge, Chelsea, Everett, Lynn, Malden, Melrose, Newton, Quincy, Salem and Somerville Associations, will be honored for membership in the Boston Association.

Schedule of Rates

Preparatory year, \$20, payable as follows: \$10 upon entering, \$5.00 November 15 and \$5.00 January 15.
Courses I and II (Chemistry and Electrical Engineering)

First year, \$35, including membership, payable as follows:—\$15 upon entering, \$10 November 15 and \$10 January 15.

Second, third and fourth years, \$50 each, including membership, payable as follows:—\$20 upon entering, \$15 November 15 and \$15 January 15.
Courses III, IV and V (Structural, Railroad and Municipal Engineering)

First year, \$30, including membership, payable as follows:—\$10 upon entering, \$10 November 15 and \$10 January 15.

Second, third and fourth years, \$50 each, including membership, payable as follows:—\$20 upon entering, \$15 November 15 and \$15 January 15.

Special Note—The following rates are in addition to membership (\$2).
In case more than one course is taken, a discount of \$3 for each additional course will be made.

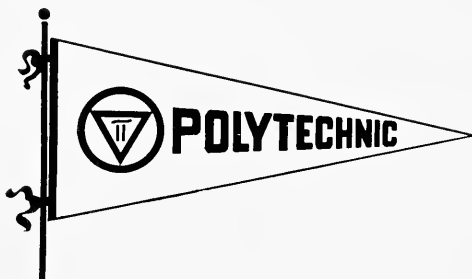
Course	Tuition	Course	Tuition
68 Adv. Alternating Currents	\$15.00	*40 and 41 Inorganic Chemistry	\$24.00
11 Adv. Mech. Drawing and Orthographic Projections	12.00	38 Life Class	20.00
116 Advanced Structures	24.00	12 Machine Drawing	11.00
170 Applied Mechanics	18.00	135 Materials of Construction	24.00
20 Architectural Drawing I	10.00	1 Mathematics P	13.00
21 Architectural Drawing II	10.00	2 Mathematics I	15.00
22 Architectural Drawing III	13.00	3 Mathematics II	15.00
112 Bridge Design	24.00	10 Mechanical Drawing P	10.00
65 Elec. Eng., Lab. A. C.	12.00	160 Municipal Eng. Problems	24.00
63 Elec. Eng., Lab. D. C.	24.00	*45 Organic Chemistry	50.00
69 Elec. Eng., Lab., Advanced	15.00	100 Practical Physics	15.00
70 Electricity Supply Stations	13.00	60 Practical Electricity	24.00
72 Electric Railways	13.00	71 Power Transmission	13.00
180 English		*42 Qualitative Analysis	32.00
64 Elements of Elec. Eng. A. C.	12.00	165 Railroad Engineering	50.00
62 Elements of Elec. Eng. D. C.	24.00	117 Concrete Construction	24.00
180 English P	10.00	155 Sanitary Engineering	24.00
140 Foundations	13.00	115 Strength of Materials	24.00
30 Freehand Drawing I	10.00	111 Structural Design	24.00
31 Freehand Drawing II	10.00	110 Structural Drawing	24.00
185 German I		113 Structural Mechanics	24.00
186 German II		131 Surveying and Plotting	24.00
*44 Gravimetric Analysis	25.00	*46 Technical Analysis	25.00
80 Heat Engineering	18.00	66 and 67 Tech. Elect. Measurements	24.00
145 Highway Engineering	18.00	47 Theoretical Chemistry I	18.00
150 Hydraulic Engineering	18.00	48 Theoretical Chemistry II	18.00
151 Hydraulic Motors	18.00	114 Theory of Structures	24.00
35 Industrial Design	10.00	130 Topographical Drawing	18.00
*49 Industrial Chemistry	18.00	*43 Volumetric Analysis	16.00

*Owing to the increased price of all material used in the chemical laboratories, due to war conditions, a laboratory fee of two dollars will be charged to each student taking courses in the chemical laboratories.

The tuition for all courses payable in advance unless stated to the contrary, in which case times of payment are indicated, Numbers preceding courses refer to description of courses. pages 17 to 40.

Students who discontinue a course, but who have attended four or more recitations in the subject, will be required to pay a term's tuition.

No student is permitted to transfer from one course to another without consulting the Dean beforehand and receiving a transfer order which must be presented at the main office for the proper ticket.



POLYTECHNIC ASSOCIATION

This is an organization formed and managed by the students. Its object is to provide social gatherings for the Polytechnic students, and to establish a bond of friendship among the men.

All men entering the Polytechnic School may join this association by filling out the proper blank at the educational office. Membership is free.

A school pin, pennant and engraved stationery with Polytechnic design may be ordered by the members.

GENERAL DEPARTMENTS

DEPARTMENT OF RECREATION AND HEALTH

ALBERT E. GARLAND, M.D., B.P.E., Director

This is under the best supervision and the aim is to better fit men for their life work by increasing their efficiency through exercise. We offer: Well equipped Indoor and Outdoor Gymnasiums, Indoor and Outdoor Running Track, Recreative, Hygienic and Educational Gymnastics, Sanitary Locker System. Numerous classes the year round. Shower, steam and electric baths; natatorium. Best instruction. Medical direction. Hand ball courts, Tennis Courts, Bowling Alleys.

DEPARTMENT OF RELIGIOUS WORK

EDWIN W. PEIRCE, Director

In order that a young man may secure a well-balanced development and attain a spiritual foundation for successful life work, the Association advises each member in planning his schedule to enter into one or more of the following activities:—

Bible Study, Sunday Meetings of Men, Personal Service Groups and The Twenty-Four-Hour-A-Day-Club.

DEPARTMENT OF SOCIAL WORK

DAVID M. CLAGHORN, Director

The attention of members is called to the many opportunities in the Association for social service, and the following social features.

A Newly Equipped Game Room

The Land and Water Club

The Association Congress

Popular Social Evenings

Lectures and Entertainments

DEPARTMENT OF EMPLOYMENT

FREDERICK W. ROBINSON, Director

The Employment Department is, in actual practice, a clearing house for young men seeking work, and employers who wish to engage reliable help. From 5000 to 8000 men apply every year. Members of the Association are given 25 per cent discount from the legal rates and special effort is made to notify them when good positions are open.

BOYS' DIVISION

JAMES G. BARNES, S.B., Boys' Work Secretary

The Boys' Division is made up of boys from Greater Boston whose needs are ministered to by a splendid force of young men who have made a careful study of "boyology." The Division contains all kinds of boys, from twelve to eighteen years of age, whose needs are studied and whose problems we try to solve. Activities are conducted along social, physical, educational and spiritual lines. The annual membership fee is \$2.00; gymnasium and natatorium privileges are open to the boys at special rates.

"S. F. E. C."

NORTHEASTERN COLLEGE

CATALOG OF THE EVENING SCHOOL OF ENGINEERING 1916-1917



Published by
NORTHEASTERN COLLEGE
OF THE
BOSTON YOUNG MEN'S CHRISTIAN ASSOCIATION
316 HUNTINGTON AVENUE, BOSTON, MASS.

Northeastern College

OF THE
BOSTON YOUNG MEN'S CHRISTIAN ASSOCIATION

SCHOOL OF LAW

Established in 1898; incorporated in 1904. Provides a four-year course in preparation for the Bar and grants the Degree of Bachelor of Laws.

SCHOOL OF COMMERCE AND FINANCE

Established in 1907; incorporated in 1911. Offers the following three and four-year courses leading to the degree of B. C. S. (Bachelor of Commercial Science); Business Administration and Professional Accountancy. Anyone passing the examination for advanced standing is enabled to complete either of the regular courses and secure the degree in three years. Special courses in addition to regular courses.

SCHOOL OF CO-OPERATIVE ENGINEERING

Four-year courses in Chemical, Mechanical, Electrical and Civil Engineering, in co-operation with business firms. Students earn while learning. Open to High School graduates.

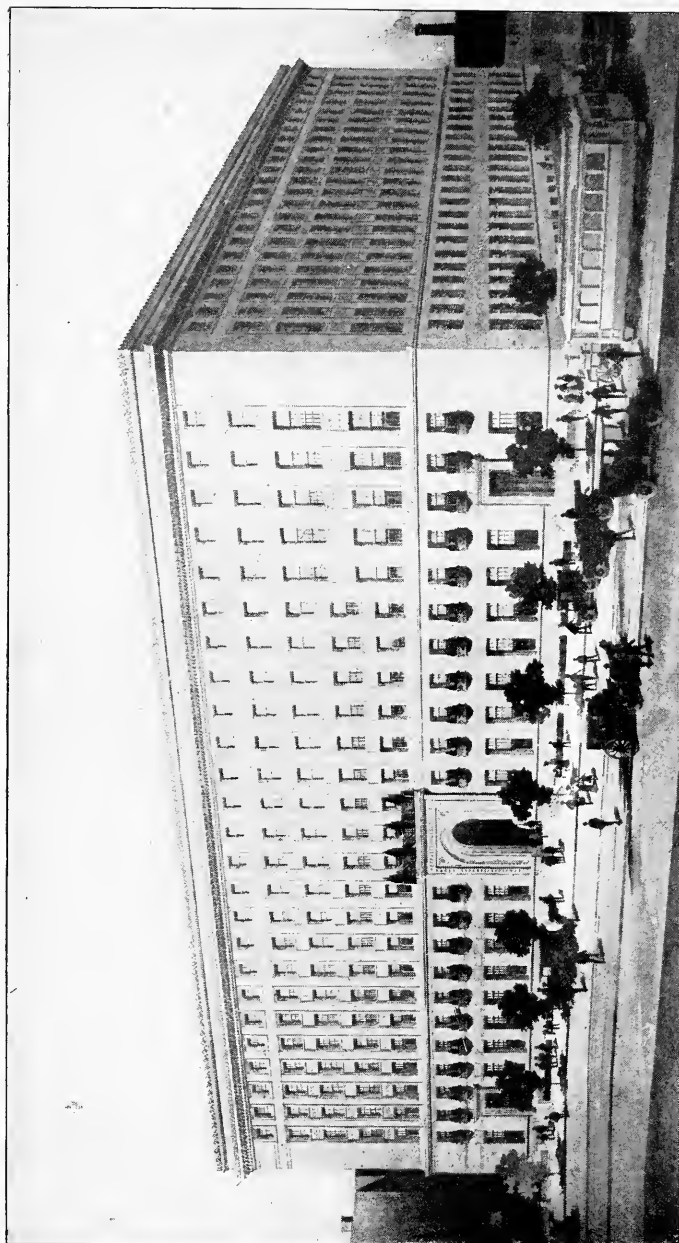
EVENING SCHOOL OF ENGINEERING

A school offering three and four-year courses in Chemistry, Chemical, Electrical, Structural, Railroad and Municipal Engineering.

SCHOOL OF LIBERAL ARTS

Beginning with the fall of 1916, courses of college grade in English, Mathematics, Science, History, and Education will be offered. Professors and instructors of New England colleges will be engaged. These courses will be open to graduates of high schools and to others who can meet the entrance requirements.

For further information concerning any of the above schools, address FRANK PALMER SPEARE, President of the College, Boston, Y. M. C. A., 316 Huntington Ave. Tel. Back Bay 4400.



ASSOCIATION BUILDING

NORTHEASTERN COLLEGE

CATALOG

OF THE

**EVENING SCHOOL
OF ENGINEERING**

BOSTON

1916-1917



Published by

NORTHEASTERN COLLEGE

BOSTON YOUNG MEN'S CHRISTIAN ASSOCIATION

*Catalog of the Instructing Staff, together with a
Statement of the Requirements for Admission
and a Description of the Courses of Instruction*

Calendar 1916-1917

September 18-21
REGISTRATION

September 21
OPENING OF SCHOOL

October 12
COLUMBUS DAY
HOLIDAY

November 30
THANKSGIVING DAY
HOLIDAY

December 18-25
CHRISTMAS RECESS

February 22
WASHINGTON'S BIRTHDAY
HOLIDAY

April 14
CLOSE OF SCHOOL

Northeastern College

BOSTON YOUNG MEN'S CHRISTIAN ASSOCIATION

OFFICERS AND MEMBERS OF THE CORPORATION

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ARTHUR S. JOHNSON

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ALBERT H. CURTIS

2ND VICE-PRESIDENT
WILLIAM E. MURDOCK

3RD VICE-PRESIDENT
GEORGE W. MEHAFFEY

SECRETARY
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H. BRADLEE FENNO	CHAS. W. PERKINS
HENRY G. LORD	THOS. H. RUSSELL
FRANCIS P. LUCE	SABIN P. SANGER
FRANK P. SPEARE	

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PRESIDENT
FRANK P. SPEARE, M.H.

SECRETARY-BURSAR
GALEN D. LIGHT, A.B.

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Mass. Inst. Tech.

DEAN

JAMES BROUGH

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B. S. BROWN

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C. P. ELDRED, S.B.

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CARL S. ELL, S.B., M.S.

STRUCTURAL ENGINEERING

C. A. FARWELL, S.B.

STRUCTURAL ENGINEERING

FRED G. HARTWELL

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MECHANICAL ENGINEERING

NATHANIEL S. MARSTON, S.B.

ELECTRICAL ENGINEERING

EDWARD MUELLER, A.B., PH.D.

CHEMISTRY

Officers of Instruction

(Continued)

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GERMAN

THOMAS E. PENARD, S.B.

MATHEMATICS

M. F. PINKHAM

MATHEMATICS

CHARLES H. RESTALL, S.B.

RAILROAD ENGINEERING

E. W. G. SMITH

MECHANICAL DRAWING

IRA SMITH

ELECTRICAL PRACTICE AND CONSTRUCTION

W. LINCOLN SMITH, S.B.

ELECTRICAL ENGINEERING

ELLWOOD B. SPEAR, A.B., Ph.D.

CHEMISTRY

SAMUEL A. S. STRAHAN

CHEMISTRY

GEORGE A. TRUELSON

ARCHITECTURE

W. F. WILLMANN

MECHANICAL DRAWING

FRED L. DAWSON

FIELD REPRESENTATIVE

T H E N E W N A M E NORTHEASTERN COLLEGE

FOR many years the terms Evening Law School, School of Commerce and Finance, Polytechnic School and Co-operative Engineering School, have been applied to the corresponding schools of the Department of Education. These names, however, were not distinctive, and both graduates and students have requested that a regular title be given the schools doing work of college grade. As a result of their activities, the schools concerned have been very thoroughly investigated by outside educational experts, to see if the scope and grade of work done would properly measure up to that of the recognized colleges and technical schools. Such was found to be the case in all the schools, and upon the submission of the various reports by the Educational Committee to the Board of Directors of the Association, the latter Board voted to apply the name "Northeastern College" to the group of schools comprising the following:—

EVENING LAW SCHOOL

SCHOOL OF COMMERCE AND FINANCE

CO-OPERATIVE ENGINEERING SCHOOL

POLYTECHNIC SCHOOL

(NOW EVENING SCHOOL OF ENGINEERING)

SCHOOL OF LIBERAL ARTS

These schools will henceforth be known as the regular schools of Northeastern College, of the Boston Young Men's Christian Association.

The name of the Polytechnic School has been changed to Evening School of Engineering, to be in agreement with the names of the other schools of the system.

F O R E W O R D

MANY men employed in engineering and other work of a technical nature, feel the need of special instruction but cannot afford to take the time to attend the regular technical day schools. To such men the Evening School of Engineering offers a large number of special courses, and to those who are willing to give three evenings per week for a period of from three to five years the school offers several regular courses of very high grade which compare favorably with similar courses given in the good technical schools of the country.

On the following pages will be found a complete description of the regular and special courses, requirements for admission, rates of tuition and other general information.

Courses of Study

Regular Courses

- I.—Chemistry and Chemical Engineering
- II.—Electrical Engineering
- III.—Structural Engineering
- IV.—Civil Engineering
- V.—Mechanical Engineering

Schedule of Subjects

No.	Course	No. Weeks	Evenings	Time
2	Mathematics I	28	Mon., Thurs. Sect. A Sect. B	7.00-7.45 7.45-8.30
3	Mathematics II	28	Mon., Thurs. Sect. A Sect. B	7.00-7.45 8.30-9.30
10	Mechanical Drawing	6	Wed. (or Thurs.)	7.00-9.30
11	Adv. Mech. Drawing and Orthographic Projections	28	Wed.	7.00-9.30
12	Machine Drawing	28	Wed.	7.00-9.30
20	Architectural Drawing I	28	Mon., Fri.	7.00-9.00
21	Architectural Drawing II	28	Mon., Fri.	7.00-9.00
22	Architectural Drawing III	28	Mon., Fri.	7.00-9.00
30	Freehand Drawing I	28	Tues., Thurs.	7.30-9.30
31	Freehand Drawing II	28	Tues., Thurs.	7.30-9.30
35	Industrial Design	28	Tues., Thurs.	7.30-9.30
38	Life Class	28	Tues., Thurs.	7.30-9.30
40	Inorganic Chemistry Lect.	28	Mon., Thurs.	7.00-7.45
41	Inorganic Chemistry Lab.	28	Wed.	7.00-9.30
42	Qualitative Analysis	28	Mon., Tues.	A
43	Volumetric Analysis	14	Mon., Tues.	A
44	Gravimetric Analysis	14	Mon., Tues., Wed.	A
45	Organic Chemistry	28	Mon., Tues., Wed.	A
46	Technical Analysis	28	Mon.	A
47	Theoretical Chemistry I	28	Wed.	8.30-9.30
48	Theoretical Chemistry II	28	Thurs.	7.00-7.45
49	Industrial Chemistry	28	Mon.	7.45-8.30
60	Practical Electricity	28	Mon., Thurs.	7.00-7.45
61	Practical Electricity, Lab.	28	Wed.	7.00-9.30
62	Elem. of Elect. Engineering; Direct Currents	28	Mon., Thurs.	7.45-9.30
63	Elect. Engineering, Lab. Direct Currents	28	Wed.	7.00-9.30

ENGINEERING SCHOOL

No.	Course	No. Weeks	Evenings	Time
64	Elem. of Elect. Engineering; Alternating Currents	28	Mon.	8.00-9.30
65	Elect. Engineering, Lab. Alternating Currents	5	Thurs.	7.00-9.30
66	Technical Elect. Measurements	28	Mon.	7.00-8.00
67	Tech. Elec. Measurements, Lab.	23	Thurs.	7.00-9.30
68	Adv. Alternating Currents	28	Tues., Thurs.	7.00-8.30
69	Elec. Eng. Lab.; Advanced	28	Wed.	7.00-9.30
70	Electricity Supply Stations	28	Tues.	8.30-9.30
71	Power Transmission	14	Thurs.	8.00-9.30
72	Electric Railways	14	Thurs.	8.00-9.30
75	Thesis	28	Fri.	7.00-9.30
100	Practical Physics	28	Mon., Thurs.	8.30-9.30
110	Structural Drawing	28	Tues.	7.00-9.30
111	Structural Design	28	Tues.	7.00-9.30
112	Bridge Design	28	Tues.	7.00-9.30
113	Structural Mechanics	28	Mon., Thurs.	7.00-8.30
114	Theory of Structures	28	Mon., Thurs.	7.00-8.15
115	Strength of Materials	28	Mon., Thurs.	8.15-9.30
116	Advanced Structures	28	Mon., Thurs.	7.00-8.30
117	Concrete Construction	28	Mon., Thurs.	8.15-9.30
130	Topographical Drawing	20	Tues.	7.00-8.30
131	Plane and Topo. Surveying	28	Mon., Thurs.	7.00-8.30
132	Advanced Surveying	8	Mon., Thurs.	8.30-9.30
135	Materials of Construction	18	Mon., Thurs.	7.00-8.15
140	Foundations	8	Mon., Thurs.	7.00-8.15
145	Highway Engineering	28	Tues.	8.30-9.30
150	Railroad Engineering	20	Mon., Thurs.	8.30-9.30
151	Railroad Drawing	28	Tues.	7.00-9.30
153	R. R. Engineering and Design	28	Tues.	7.00-9.30
160	Municipal Engineering	28	Tues.	7.00-9.30
170	Mechanism	28	Mon.	7.00-8.30
171	Mech. Eng. Drawing	28	Thurs.	7.00-8.30
175	Applied Mechanics	28	Mon., Thurs.	8.15-9.30
180	Thermodynamics	28	Tues.	7.00-8.00
181	Boilers and Prime Movers	28	Mon., Thurs.	7.00-8.15
182	Power Plant Design	28	Tues.	7.00-8.30
185	Hydraulic Engineering	28	Mon., Thurs.	8.30-9.30
186	Hydraulic Motors	28	Tues.	8.00-9.30
200	German I	28	Wed.	7.00-7.45
201	German II	28	Wed.	7.45-8.30

A. Hours of instruction will be announced at opening of school.
 Note: For prices see schedule of rates, page 47.

NORTHEASTERN COLLEGE

COURSES OF STUDY

I. Chemistry and Chemical Engineering

First Year

	Course No.
Mathematics I	2
Practical Physics	100
Inorganic Chemistry, Lectures and Recitations . .	40
Inorganic Chemistry, Laboratory	41

Second Year

Mathematics II	3
Qualitative Analysis, Lectures and Recitations . .	42
Qualitative Analysis, Laboratory	42
Mechanical Drawing	10

Third Year

Volumetric Analysis	43
Gravimetric Analysis	44
German I	200

Fourth Year

Organic Chemistry, Lectures	45
Organic Chemistry, Laboratory	45
Theoretical Chemistry I	47
German II	201

Fifth Year—For Chemical Engineering Students Only

Technical Analysis	46
Theoretical Chemistry II	48
Industrial Chemistry	49
Thermodynamics	180
Practical Electricity	60

Note: For hours of instruction see schedule of subjects on pages 8 and 9.
For descriptions of courses see pages 15 to 39.

ENGINEERING SCHOOL

COURSES OF STUDY

II. Electrical Engineering

First Year

	Course No.
Mathematics I	2
Mechanical Drawing	10
Practical Physics	100
Practical Electricity, Lectures and Recitations	60
Practical Electricity, Laboratory	61

Second Year

Mathematics II	3
Elements of Electrical Engineering, Direct Currents, Lectures and Recitations	62
Electrical Engineering, Laboratory, Direct Currents	63

Third Year

Elements of Electrical Engineering, Alternating Cur- rents, Lectures and Recitations	64
Electrical Engineering, Laboratory, Alternating Currents	65
Technical Electrical Measurements	66
Technical Electrical Measurements, Laboratory	67
Hydraulic Motors	186
Thermodynamics	180

Fourth Year

Advanced Alternating Currents	68
Electrical Engineering, Laboratory, Advanced	69
Electricity Supply Stations	70
Power Transmission	71
Electric Railways	72
Thesis	75

Note: For hours of instruction see schedule of subjects on pages 8 and 9.
For descriptions of courses see pages 15 to 39.

NORTHEASTERN COLLEGE

COURSES OF STUDY

III. Structural Engineering

First Year

Course No.

Mathematics I	2
Practical Physics	100
Mechanical Drawing	10

Second Year

Mathematics II	3
Structural Mechanics	113
Structural Drawing	110

Third Year

Theory of Structures	114
Strength of Materials	115
Structural Design	111

Fourth Year

Advanced Structures	116
Bridge Design	112
Concrete Construction	117

Note: For hours of instruction see schedule of subjects on pages 8 and 9.
For descriptions of courses see pages 15 to 39.

ENGINEERING SCHOOL

COURSES OF STUDY

IV. CIVIL ENGINEERING

Options — { Municipal Engineering
Railroad Engineering

First Year

	Course No.
Mathematics I	2
Practical Physics	100
Mechanical Drawing	10

Second Year

Mathematics II	3
Plane and Topographic Surveying	131
Topographical Drawing	130
Highway Engineering	145

Third Year

Structural Mechanics	113
Advanced Surveying	132
Railroad Engineering	150
Railroad Drawing	151

Fourth Year—To be omitted during 1916-17

Railroad Engineering and Design (Optional)	153
Municipal Engineering Problems (Optional)	160
Foundations	140
Materials of Construction	135
Hydraulic Engineering	185

Note: For hours of instruction see schedule of subjects on pages 8 and 9.
For descriptions of courses see pages 15 to 39.

NORTHEASTERN COLLEGE

COURSES OF STUDY

V. Mechanical Engineering

First Year

	Course No.
Mathematics I	2
Practical Physics	100
Mechanical Drawing	10

Second Year

Mathematics II	3
Mechanism	170
Mechanical Engineering Drawing	171
Machine Drawing	12

Third Year—To be omitted during 1916-17

Applied Mechanics	175
Thermodynamics	180
Hydraulic Motors	186
Materials of Construction	135
Foundations	140

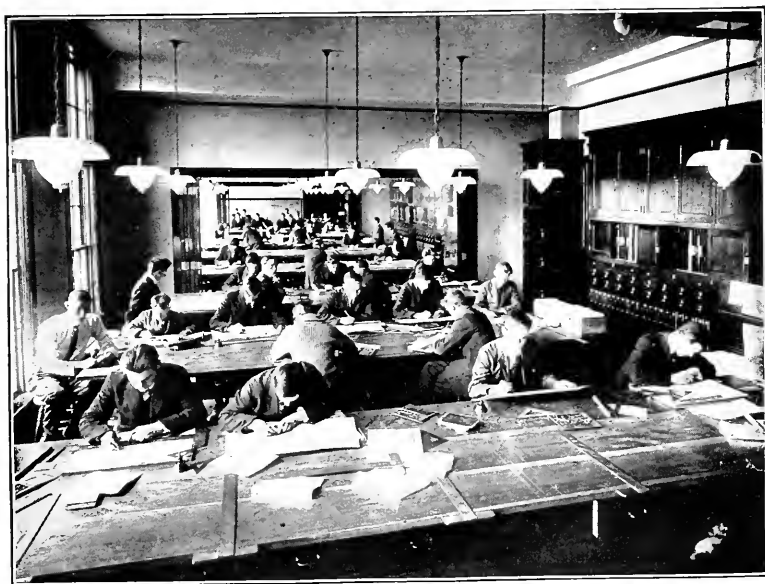
Fourth Year—To be omitted during 1916-17

Boilers and Prime Movers	181
Power Plant Design	182
Concrete Construction	117
Practical Electricity	60

Note: For hours of instruction see schedule of subjects on pages 8 and 9.
For descriptions of courses see pages 15 to 39.



REFERENCE LIBRARY



DRAFTING ROOM

Subjects of Instruction

DEPARTMENT OF MATHEMATICS

Director:

THOMAS E. PENARD, S.B.

Instructors:

THOMAS E. PENARD, S.B.

MR. M. F. PINKHAM

THE importance of mathematics as a means of mental discipline, and as a necessary basis for those intending to pursue engineering as a profession, cannot be overestimated.

Students taking the regular courses in Chemistry and Engineering are given two years instruction in applied mathematics, as outlined in Mathematics I and II. Special attention is called to these two courses in practical mathematics, which are intended to cover the field in so far as mathematics is ordinarily employed in the usual engineering computations. They are designed primarily for students taking the regular engineering courses, but may be taken to advantage by those regularly employed in engineering work who wish to obtain a more thorough grasp of applied mathematics.

Courses in advanced applied mathematics will be given provided a sufficient number of men apply to form a class.

1. Mathematics P. (Evening Preparatory School)

Preparation: Arithmetic.

This course of two periods per week during the preparatory year is designed primarily for students taking the regular engineering courses; it is hoped, however, that it will be found adapted to the needs of others who wish to obtain a practical knowledge of elementary mathematics. The student is assumed to be thoroughly familiar with the fundamental operations of arithmetic. It includes:

Review arithmetic.

Algebra, including definitions and notation, fundamental operations, factoring, fractions, simple equations, powers and

NORTHEASTERN COLLEGE

roots, ratio and proportion, variation, with applications to problems chosen from electricity and mechanics, formulas.

Geometry, including useful theorems relating to plane figures, measurements of triangle, polygons, circle, polyhedrons, cylinder, cone and sphere.

2. Mathematics I.

Preparation: Mathematics P (1), or equivalent.

This course of two periods per week during the first year, is a continuation of Mathematics I. It includes:

Review Algebra and Geometry.

Logarithms, the use of slide rules, discussion of precision and rules for significant figures.

Trigonometry including circular measure, co-ordinates, trigonometric ratios, formulas, law of sines, law of cosines, solution of right and oblique triangles, applications to problems in Physics and Engineering.

3. Mathematics II.

Preparation: Mathematics II (2), or equivalent.

This course of two periods per week during the second year is a continuation of Mathematics II. It includes:

Plotting of functions, interpolation, the straight line, curves represented by various equations, graphic solution of equations, determination of laws from the data of experiments, simplification of formulas.

Rate of increase differentiation, determination of maxima and minima by differentiation, integration, definite integrals, determination of mean value, area and volume by integration, centre of gravity, moment of inertia, partial differentiation.

Analytic Geometry and Calculus.

See Mathematics II

ENGINEERING SCHOOL

DEPARTMENT OF DRAWING

Instructors:

MR. JAMES BROUGH

MR. E. W. G. SMITH

MR. GEORGE A. TRUELSON

MR. W. F. WILLMANN

The courses in Mechanical and Architectural Drawing, as outlined, afford the essentials of drafting for those contemplating office work and are equally valuable and necessary to those working in the allied trades.

The art courses are varied and the work is thorough and complete, and of a high order. Great care is taken to develop the student along the line of his natural inclinations, and, so far as possible, to have the work of the school bear directly upon his daily employment and other courses attended.

10. Mechanical Drawing.

This course consists of work in the drawing room, occupying one evening a week throughout the entire first year. The drawing is of an elementary character, beginning with instruction in the use of instruments and the fundamental rules for executing engineering drawings. In conjunction with the drawing, the elementary principles of orthographic projections are studied, and the student prepares a number of plates illustrating the reproduction of objects in the shape of working drawings.

For students taking electrical engineering the course will be limited to the first fourteen weeks.

11. Advanced Mechanical Drawing and Orthographic Projections.

This course is a continuation of Mechanical Drawing (10) It includes:

Problems on the point, line and plane, projections of solids, single and double curved surfaces and their intersections by oblique planes, and practical illustrations of the principles studied.

NORTHEASTERN COLLEGE

12. Machine Drawing.

The aim of the course is to teach the proper way of making the necessary dimensioned drawings for use in practice. The instruction includes: (a) The making of sketches of the parts of a machine from measurements; (b) the detail scale drawing from the sketches and a tracing; (c) an assembly drawing of the machine.

20. Architectural Drawing I.

An elementary course, including the fundamental principles underlying all kinds of mechanical and architectural drawing; geometrical problems; orthographic and isometric projections; classical mouldings; Roman alphabet, and roof problems.

In connection with this course the instructor will outline a course of reading in architectural history.

21. Architectural Drawing II.

The orders of Architecture. Practical architecture and details of construction. In this course the student is taught the component parts of buildings. Typical details of construction are drawn to a large scale and in isometric projection.

22. Architectural Drawing III.

This course covers the making of complete plans, elevations and working drawings of some elementary problem.

Special Students

Students desiring special work in Architectural Drawing, not outlined above, should consult with the instructor.

30 and 31. Freehand Drawing.

Considering the great importance of the study of freehand drawing to all who are engaged in, or anticipate being engaged in any industrial art, artistic trade or profession, we offer a very complete course in this line, and call attention to the splendid advantages provided.

ENGINEERING SCHOOL

The work is adapted to the requirements of each individual student, so far as is practical and consistent with a thorough training in freehand drawing. There are two classes in both freehand drawing and industrial design.

Class I. The work of this class is intended to meet the wants of those students who have no previous knowledge of freehand drawing and is recommended to all students who intend to become craftsmen, designers, architects or artists, and also to others who may wish to take up the study as an accomplishment. The work will consist of drawing from typical models, by which students learn a sense of proportion and the principles of perspective; groups of still life for the study of composition and color; also drawing of historic ornament, and details of the human figure from the cast, by which students are taught to observe form, and the principles of light and shade.

Class II. The course of study in this class is of a more advanced nature than that of Class I, and in addition to the more complicated forms of ornament, the full-length human figure from the antique is added, also rendering in pen and ink and pencil, advanced shading in charcoal, painting groups of still life in monochrome and polychrome, in oil and water colors.

35. Industrial Design and Interior Decoration.

The courses in industrial design and interior decoration are specially helpful to those students who are already engaged in or anticipate being engaged in such arts and crafts, as wood and stone carving, wrought and bent-iron work, brass and copper work, stained glass, furniture and drapery, interior decoration, book covers, wall paper, fabrics and other allied industrial arts, including lettering and commercial designing for advertising purposes. No limitation is placed upon the student who shows ability to take up the work prescribed for the class he wishes to enter, and students who so desire may spend part of their time in the freehand class and part in the industrial design and interior decoration class, without extra charge. The instructor is a certified art master and one of the leaders of the profession. Students in industrial design are recommended to take architecture.

NORTHEASTERN COLLEGE

Class I. The studies in this class include the work of the freehand drawing in Class I, with the addition of special studies given for the purpose of design, such as a systematic study of the various styles of historic ornament, studies of animal and plant form, and the elementary principles of design.

Class II. Students who have an elementary knowledge of drawing and design are considered eligible for this class and are taught the more advanced principles of composition, form and color in design, also rendering the same in various mediums, including charcoal, pencil, pen and ink, water and oil colors.

Our special library can be consulted by the students in these classes.

38. Life Class.

At the repeated request of a number of advanced students we offer this class which will give an exceptional opportunity to students who wish to pursue their studies for the purpose of acquiring a more perfect knowledge of the figure, and will be of great advantage to those who wish to become more proficient in this branch of art. At the present time the use of the figure is introduced into nearly every form of art work, not only in a purely artistic sense, but also in many forms of commercial work, and to be able to draw the figure well is a great achievement to the artist and designer.

Mechanical Engineering Drawing. See Dept. of Mechanical Engineering

Railroad Drawing. See Dept. of Civil Engineering

Structural Drawing. “ “ Structural Engineering

Topographical Drawing. “ “ “

ENGINEERING SCHOOL
DEPARTMENT OF CHEMISTRY AND CHEMICAL
ENGINEERING

Director:

ELLWOOD B. SPEAR, A.B., PH.D.

Instructors:

ELLWOOD B. SPEAR, PH.D. EDWARD MUELLER, S.B., PH.D.
AND ASSISTANTS

The wonderful advance in the application of science to the arts during the past few years has caused a great demand for technically trained men. Nearly every large manufacturing concern now employs chemists regularly, or else has experts whom it can consult at short notice. The scientific and technical schools are each year sending out large classes of young men, especially trained to meet this demand. For a young man to acquire this education requires four years at a scientific, or technical school, in addition to the four years necessary for preparation at the secondary school, and an outlay of from two to three thousand dollars. These necessary expenditures of time and money are such that many young men, who are mentally capable of taking such courses, are obliged to give up their ambitions and fill inferior positions.

Formerly the practical knowledge which young men acquired by contact with their work was sufficient, but today the degree of specialization is such that a theoretical knowledge is essential to success in many industries where chemical processes are utilized.

There are many men who, by close application to the practical side, have acquired responsible positions in technical industries, but are unfamiliar with the theoretical side of their chosen work.

Such men are unable to advance in their special lines, because they cannot read the many valuable books written on special technical subjects, which presuppose a general knowledge of the theory of chemistry.

At the present time, the requirements of admission to the higher institutions of learning, even for special students, are

NORTHEASTERN COLLEGE

such that the doors are practically closed to these men, although many of them could take special courses with profit. Again the only available hours for such men are during the evening. There is a demand, therefore, for a systematic evening course in chemistry, which will be open to men engaged at the present time in technical industries.

Regular Students.

The school offers a thorough four-year course in the general principles and applications of inorganic, organic and analytical chemistry, sufficiently complete to enable students to pursue their work with intelligence; to correlate theory and practice; to read technical works with profit; to test the quality and purity of chemicals and to become familiar with the laboratory methods of the trained chemist.

To the student who can pursue his studies an extra year, and who has had the necessary training, the school offers a course in chemical engineering. It is the aim of this course to prepare men to aid in the operation of industries based on chemical principles.

Special Students.

Any of the courses in chemistry may be taken singly, provided the head of the department is satisfied that the student can pursue the work with profit.

Special courses may be arranged with the head of the department.

Students are especially urged to take the entire work on the schedule of each year. A good grounding in mathematics, physics and German is essential to success in the chemical subjects of the third and fourth years.

Laboratories.

The laboratories in the new building on Huntington Avenue are fitted with an excellent equipment in up-to-date apparatus, to give thorough instruction in all the courses offered.

A laboratory deposit of three dollars for the first year, and four dollars for all other years, must be paid before desks will be

ENGINEERING SCHOOL

assigned. Students who have not checked up their desks by the end of the school year will be charged one dollar extra.

Owing to the increased prices of all materials used in the chemical laboratories, due to war conditions, a laboratory fee of two dollars will be charged to each student taking courses in the chemical laboratories.

The School makes an effort to secure positions for those who have successfully completed the course in chemistry, or chemical engineering.

40. Inorganic Chemistry.

A course of fifty-six experimental lectures on the fundamental laws and principles of inorganic chemistry. The course aims to familiarize the student with the properties and preparation of the following elements and their most important compounds:—oxygen, hydrogen, the halogens, sulfur, nitrogen, phosphorus, carbon, silicon, the alkali and alkaline earth groups, iron and aluminum. The course is to be taken in conjunction with (41).

Text book:

General Chemistry for Colleges, Smith.

41. Inorganic Chemistry Laboratory.

A laboratory course of 28 weeks, 90 periods in which the student is expected to verify and illustrate the facts and principles that have been discussed in the lectures. To be taken in conjunction with (40).

Text book:

Laboratory Experiments in Inorganic Chemistry, Spear.

Courses (40) and (41) are well adapted to the needs of those who wish to take the College Entrance examinations.

42. Qualitative Analysis.

Preparation: (40) and (41), or an equivalent.

A practical course in qualitative analysis of 28 weeks, 140 periods duration, in the second year. The course relates to the identification of the common metallic elements and the ordinary acids.

NORTHEASTERN COLLEGE

Each student is expected to make complete and accurate analyses of various mixtures, alloys and chemicals used in the industries. The laboratory work is supplemented by lectures and conferences.

Text books:

General Chemistry for Colleges, Smith.

Qualitative Chemical Analysis, A. A. Noyes.

43. Volumetric Analysis.

Preparation: (40), (41), (42) or equivalent.

A course of 14 weeks, 98 periods, in the third year on volumetric determinations, involving the use and the standardization of burettes, pipettes and measuring flasks. The course includes alkalimetry, acidimetry, indicators, oxidimetry, iodimetry, chlorimetry. The laboratory work is supplemented by lectures and conferences.

Text book:

Quantitative Chemical Analysis, Talbot.

44. Gravimetric Analysis.

Preparation: (40), (41), (42), (43) or equivalent.

A course of 14 weeks, 98 periods, devoted to the principles and practice of gravimetric analysis. The laboratory work is supplemented by lectures and conferences.

Text books:

Quantitative Chemical Analysis, Talbot.

Analytical Chemistry, Treadwell and Hall, Vol. 2.

45. Organic Chemistry.

Preparation: (40), (41), (42), (43), (44).

A course consisting of 196 periods during the fourth year. The course is devoted to lectures, conferences and laboratory work, on the principles of organic chemistry, as illustrated by the methane and benzene derivatives. The student is required to prepare in the laboratory a number of organic compounds, selected to show the characteristic reactions, and to give training in the practical separation and purification of organic

ENGINEERING SCHOOL

substances. After this synthetic work, the students are given a practical course in organic analysis.

Text books:

Holleman, Text-book of Organic Chemistry; Gatterman, Practical Methods in Organic Chemistry, translation by Schober. Laboratory notes by the instructor.

46. Technical Analysis.

Preparation: (45) or an equivalent.

A course of 28 periods in the fifth year, on the following:
Analysis of gases.

Analysis and testing of mineral, animal and vegetable oils.

The origin, manufacture, properties, uses and analysis of the various fuels, and the determination of the heat value of fuels by the use of a calorimetric bomb.

47 and 48. Theoretical Chemistry I and II.

Preparation: (3), (42), (43), (44).

A course of 56 lectures and conferences on chemical equilibrium and electro-chemical topics. The course will include lecture experiments and discussion of problems on the law of mass action applied to the rate and equilibrium of chemical reactions, the effect of temperature and pressure, the conduction of electricity by solutions, the production of electricity by chemical change, the electromotive force of voltaic cells and single potential differences. Problems for independent solution by the student will also be given.

49. Industrial Chemistry.

Preparation: (42), (43), (44), (45).

A course of 28 lectures and conferences on the more important chemical processes. Attention is given to many operations of a general nature common to chemical industries, such as crushing, grinding, filtration, evaporation, distillation, etc. and to the apparatus employed in these processes. Some of the more important industries will be taken up in detail.

Text book:

Thorp, Outlines of Industrial Chemistry.

N O R T H E A S T E R N C O L L E G E

D E P A R T M E N T O F E L E C T R I C A L E N G I N E E R I N G

Director:

NATHANIEL S. MARSTON, S.B.

Instructors:

NATHANIEL S. MARSTON, S.B. C. P. ELDRÉD, S.B.

MR. F. G. HARTWELL MR. IRA SMITH

The course in electrical engineering is intended primarily to cover the needs of two classes of men: (1) men who are working in the electrical trades, or other mechanical trades involving the use of electricity, who desire to increase their knowledge of practical electricity and to gain a thorough understanding of the electrical engineering principles and their broader application, such as to prepare them for positions of foremen, superintendents, or operating managers in their particular field; (2) young men in business possessing a good general education, who wish to gain a knowledge of the technical matters of electricity, together with a sufficiently broad conception of the theories underlying all electrical engineering work, in order to render themselves more useful in their line of business by the combined general and technical training.

The ideal condition for laying out a single course to serve the variety of needs represented by the individual interests of the students, would obviously be exact equality of preparation for all students beginning the work of the first year. Though such equality cannot be expected of all the men entering the first year, there must be a certain general basis of preparation, in order that the work may be of the greatest benefit to the largest number of men; therefore, the work of the first year has been laid out in such a way as to be of no special difficulty to those with a high school training or the equivalent thereof; at the same time, certain men who have not had such preparation, but whose experience in practical life has sufficiently matured them, should be able to enter the first year with success though they may be required to make up some of the preparatory work, while they may be excused from certain portions

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of the practical work with which their experience may have brought them into contact. It is recommended that such men should consult with the Dean or the Director in arranging their schedule. In general, a man entering the first year should (1) have easy command of the English language, such as to enable him to express himself and write clearly, (2) be familiar with elementary mathematics and algebra.

Men with advanced training and experience will be admitted to the second or third year, in accordance with their preparation. Such men should not only study the program presented below, but should submit their case to the Dean or Director.

Students are invited to avail themselves of consultations with the various instructors, whenever desirable.

60. Practical Electricity.

First Year—Two classroom exercises per week for 28 weeks.

This course of lectures and problem work covers the following practical subjects.

1. Simple electrical apparatus such as annunciators, burglar alarms, gas-lighting systems, arc and incandescent lamps; the wiring of such apparatus, together with a thorough discussion of electric-wiring devices; moulding, conduit, knob, tube and cleat work; methods employed in wiring old and new houses.

2. Different types of d-c. motors and generators, and devices for their control; methods of installing and connecting motors and generators, and their complete circuit; practical operation of d-c. motors and generators; their troubles, causes thereof and remedies therefor; switchboard wiring and switchboard devices for direct current, both for two- and three-wire systems.

It is not intended to cover in this course the details of large generating stations and complex distribution systems with complicated apparatus and special devices, but rather those of small installations as applicable to small private plants and to the average central-station consumer. In all this work

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special emphasis is placed on the rules embodied in the *National Electric Code* and on the best methods of modern practice.

In the course of the work, reference is made to such principles of electrical engineering as are necessary to give a clear understanding of the subject under consideration, and, in that respect, this course serves as a definite preparation leading up to the second-year course on Elements of Electrical Engineering.

61. Practical Electricity Laboratory.

First Year—One entire evening each week during the last 14 weeks.

This laboratory course is to be taken simultaneously with the lecture course on Practical Electricity. The experiments cover the subjects treated under Practical Electricity.

62. Elements of Electrical Engineering, Direct Currents.

Second Year—Two 1½-hour periods per week for 28 weeks.

This course of lectures, recitations and problem work is devoted to the study of the laws and properties of electric and magnetic circuits, and of the principles and operation of direct-current machinery, and of direct-current practice.

The following topics are considered:

General principles of magnetism, the magnetic circuit.

The electric circuit, Ohm's law, Kirchhoff's law, units of resistance, current and potential.

Electromagnetic induction, the dynamo.

Direct-current generators and motors, their construction, operation and applications.

Direct-current systems, generation and distribution of power, storage batteries.

Electric lighting and photometry.

A great variety of problems based on practical engineering conditions are solved, both in class and outside, by the students.

63. Electrical Engineering Laboratory, Direct Currents.

Second Year—One entire evening each week for 28 weeks.

The experiments performed in this course are intended to supplement the class-room work of the course on Elements of

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Electrical Engineering. The first experiments cover Ohm's law, the storage battery, the operation of a dynamo as a motor and generator, the photometer, etc. In the subsequent work, the characteristics of d-c. generators and motors are determined experimentally; efficiency, losses, regulation, heating are carefully studied in the laboratory. Each student is required to furnish a complete report, including theory, method of procedure, results and conclusions, on each experiment performed by him.

64. Elements of Electrical Engineering, Alternating Currents.

Third Year—One 1½-hour period per week for 28 weeks.

This course of lectures, recitations and problem work, covers the principles of electrostatics, the theory of variable currents in the simple series circuit containing resistance, inductance and capacity, the general theory of harmonic alternating currents, single-phase and polyphase circuits, non-sinusoidal currents and voltages. The last part of the course deals with the alternator, its regulation and efficiency, the transformer, its ratio, regulation, efficiency and application. The problems illustrating the various principles are taken, whenever possible, from the field of practical engineering.

65. Electrical Engineering Laboratory, Alternating Currents.

Third Year—Five evenings during last third of year.

A series of 5 laboratory exercises in the latter part of the third year are devoted to the experimental study of a-c. circuits, the alternator and the transformer, supplementing the corresponding classroom work.

66. Technical Electrical Measurements.

Third Year—One hour per week for 28 weeks.

In this course of lectures and recitations the theory, construction and operation of the more common types of measuring instruments are studied, together with the various methods of measurements employed in modern engineering practice. Emphasis is placed upon the useful field of application, as well as on the specific practical limitations of each instrument or testing process.

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67. Technical Electrical Measurements, Laboratory.

Third Year—One evening per week in the first two thirds of the year, five exercises during the last third of the year.

The experiments carried on by the students in this course illustrate the use of the instruments and the testing methods studied in the course on "Technical Electrical Measurements," as well as the principles covered in the lectures on "Elements of Electrical Engineering; Alternating Currents." Each experiment is to be covered in a comprehensive report submitted by each student.

68. Advanced Alternating Currents.

Fourth Year—One hour per week for 28 weeks.

This course of lectures, recitations and problem work is devoted to the detailed study of the common types of a-c. machines, such as the induction motor, the synchronous motor, the rotary converter, etc.

69. Electrical Engineering Laboratory, Advanced.

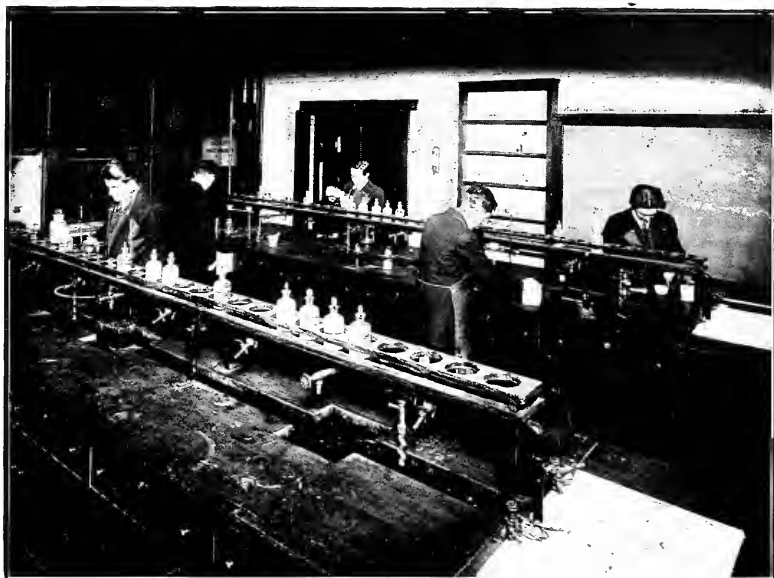
Fourth Year—One evening per week for 28 weeks.

In this course the work of the third-year course in Electrical Engineering Laboratory is continued. The more complicated types of a-c. machines are tested, and power-plant tests of the Y. M. C. A. electric plant are made. Complete reports are required on each test performed, as in the second and third-year laboratory courses.

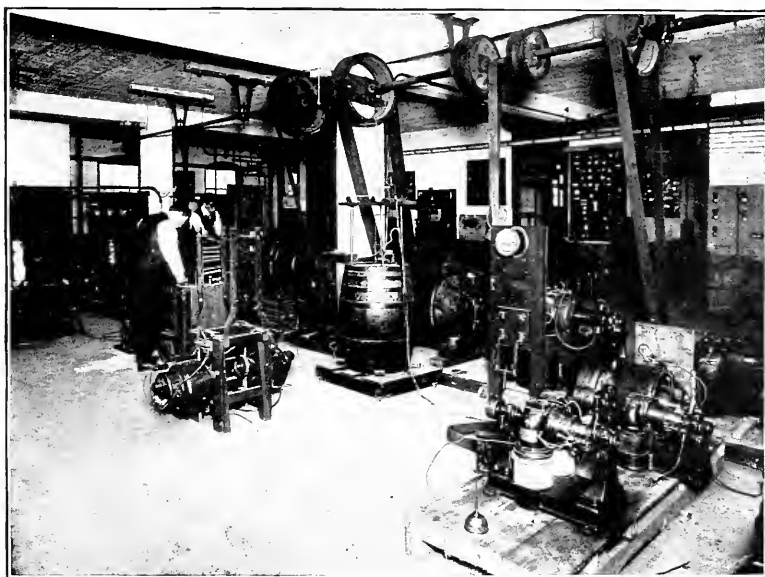
70. Electricity Supply Stations.

Fourth Year—One exercise per week for 28 weeks.

This course deals with the layout, construction and operation of electric power generating stations, substations and distribution systems. Emphasis is placed upon the characteristics, both technically and economically, of each type of station, steam power-operated, water-wheel-driven and internal-combustion-motor-operated. The various rate systems and their specific fields of merit will also be discussed.



CHEMISTRY LABORATORY
(One of Three)



CORNER OF ELECTRICAL LABORATORY

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71. Power Transmission.

Fourth Year—One 1½-hour exercise per week for 14 weeks.

In this course are considered the economic problem of power transmission, the principles governing the design and the construction of transmission lines.

72. Electric Railways.

Four Year—One 1½-hour period per week for 14 weeks.

This course includes the following subjects: Train resistance, characteristics of railway motors, design of motor equipment, electric locomotives, design of power generating and distribution system for electric railways; also such details as car construction, rails, bonding, trolley and third-rail construction. The subjects of storage-battery traction, and steam-railroad electrification are also briefly discussed.

75. Thesis.

During the final year, each student in order to qualify for a diploma, must prepare and present a report upon some piece of original work, investigation of some piece of machinery, consideration of some practical problem, or similar subject, the students working either alone or in pairs, and at such time as they please, within limits, the subjects being selected in consultation with one of the instructors, who will have immediate supervision of the work.

The object of this work is to develop the student's powers of original investigation and to teach the principles upon which the study of special problems of various kinds should be approached. It is hardly expected that the immediate results of the investigation will be of great value, in view of the time allowable, considered as contributions to engineering knowledge but it is expected and believed that the value to the student himself will be very great.

NORTHEASTERN COLLEGE
DEPARTMENT OF STRUCTURAL ENGINEERING

Director:

C. S. ELL, M.S., S.B.

Instructors:

CARL S. ELL, S.B., M.S. C. A. FARWELL, S.B.

J. R. LEIGHTON

The four years' course in structural engineering covers thorough instruction in mathematics, mechanics and the theory and practice of drafting, detailing, estimating and designing. Thorough instruction is given by means of lectures and classroom work in the important theoretical and practical principles of design, supplemented by the execution of detail drawings in the drafting room.

100. Practical Physics.

This course consists of two lectures per week, on Monday and Thursday evenings, throughout the year. Instruction is given in the practical application of physical laws. Each lecture, as far as possible, is accompanied by practical tests in the lecture room on large size apparatus, built especially for this course, so that the student may actually see a demonstration of the truth of the various laws, thus enabling him to grasp readily the underlying principles. The course is devoted to a study of the mechanics of solids, liquids and gases, heat and its effects, together with lectures on light and sound. Practical problems covering each phase of the work are given throughout the year which are designed to fix in the student's mind the fundamental principles taken up in the lectures. The supplies for this course are a set of notes on "Practical Physics" prepared by C. S. Ell, a pair of small 4 or 5 inch triangles and a 4-inch cardboard protractor.

110. Structural Drawing.

The course in structural drawing occupies one evening a week throughout the entire second year. The course consists

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in the working out of various graphical problems of mechanics on the drawing board, drawing standard sections of structural steel shapes, structural details and the preparation of drawings, representing simple structures. The purpose of this course is to familiarize the student with detailed drawings and teach him where and how to dimension structural parts on working drawings.

111. Structural Design.

The course in structural design consists of work in the drawing room, one complete evening each week throughout the third year. It is a continuation of the course in structural drawing given in the second year, and includes the execution of elementary structural design, taking up in a practical way the principles given in the course in Theory of Structures. Each student is given data for various problems, the designs for which he works out in the drawing-room, making all necessary computations and executing all drawings necessary for the preparation of a complete design of a number of engineering structures.

112. Bridge Design.

The course in bridge design occupies one complete evening a week throughout the fourth year. Most of the work is done in the drawing room, but instruction is given from time to time by means of lectures. The work includes the execution of complete designs for several types of railroad bridges and the execution of complete working drawings.

113. Structural Mechanics.

This course consists of one period on Monday and Thursday evenings, throughout the second year. The course covers the fundamental principles of statics, a study of the centre of gravity and the moment of inertia of plane figures and the application of the various principles of mechanics to the solution of simple structural problems. The work consists of lectures, recitations and the solution of problems, many of which are done in the drawing room.

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114. Theory of Structures.

This course occupies one period on Monday and Thursday evenings throughout the third year and consists of lectures, recitations and solution of problems. In this course instruction is given in the fundamental theory of structures including the theory of beams, computation of reactions, moments, shears for static and moving loads. The work in the class-room is supplemented by the solution of many practical problems in the drawing room.

115. Strength of Materials.

This course occupies one period on Monday and Thursday evenings throughout the third year, consisting of lectures, recitations and the solution of problems. Instruction is given in the strength of materials, mathematically treated, including the stresses and strains in bodies subjected to tension, to compression and to shearing; common theory of beams, with thorough discussion of the distribution of stresses, shearing forces, bending moments, slopes, and deflections.

A study is also made of the strength of hooks, columns, shafts, and springs, and combined stresses in beams subjected to tension and compression, as well as bending. A brief consideration of strains, and the relations of the stresses on different planes in a body and the stresses in simple frames subjected to bending forces, is taken up in the latter part of the course.

116. Advanced Structures.

This course occupies one period on Monday and Friday evenings, throughout the fourth year. It is a continuation of the theory of structures given in the third year and takes up the fundamental principles involved in the design of various engineering structures, such as buildings, bridges, retaining walls, arches and other structures, as the time permits. Instruction is given by means of lectures and recitations and the various theoretical principles are applied in the execution of practical designs in the drawing room.

117. Concrete Construction.

This course occupies one period on Monday and Thursday evenings throughout the fourth year. Instruction is given in

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the history and early use of cement; different kinds of cement manufacture; sand, gravel, broken stones, and methods of mixing; description of concrete work; roadways, sidewalks, building work, footings, foundations, conveying concrete, placing, finishing and waterproofing; principles of reinforced concrete, formulas for calculating strength, tables of strength, values; reinforcing steel, expanded metals, wire fabrics; design and construction. Simple formulas and application, use of tables, beams, and girders, bearing power of soil, forms and molds, removal of forms, problems in beam, slab and girder designs, and arches. Cost estimating and requirements of the building laws.

DEPARTMENT OF CIVIL ENGINEERING

Director:

JOHN W. HOWARD, S.B.

Instructors:

JOHN W. HOWARD, S.B. CHARLES H. RESTALL, S.B.

The courses in Railroad Engineering and Municipal Engineering which have heretofore been given separately have been combined to form the course in Civil Engineering which is herein outlined.

Two options are offered in the fourth year; one in Railroad Engineering and one in Municipal Engineering.

Students wishing to take separate subjects may do so on approval of the Dean.

130. Topographical Drawing.

Preparation: Mechanical Drawing (10).

This course of 28 weeks in the second year is primarily designed to give training in the interpretation and drawing of topographical maps. It consists of one and one-half hours per week in the drawing room, devoted to the study of the different conventional signs employed, and each student is required to make a number of plates and to become reasonably proficient in the preparation of such maps. Particular attention is given to the study of contour maps, and the solution of problems relating thereto.

Thirty-five

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131. Plane and Topographic Surveying.

Preparation: Trigonometry or Math. II (3)

The course in plane and topographic surveying consists of three hours instruction each week during the second year.

The first term is devoted to a study of surveying instruments, the methods of making surveys and the solution of problems in plane surveying.

In the second term the methods used in topographic surveying, together with the problems relating thereto, are taken up in detail, as well as advanced and special problems in plane surveying.

Special emphasis is laid on the construction and use of the various kinds of maps and plans with which the surveyor should be familiar.

132. Advanced Surveying.

Preparation: Plane and Topographic Surveying, (131).

This course consists of three hours instruction per week for the first eight weeks of the third year. Higher problems in surveying such as triangulation, precise, trigonometric and barometric leveling, map projection, and the plane table are discussed.

135. Materials of Construction.

A course of two and one-half hours per week during the first eighteen weeks of the fourth year, taking up a consideration of the properties of the various materials used in engineering construction, such as wood, iron, steel, brick, stone, cement and concrete.

140. Foundations.

A course of two and one half hours per week during the last ten weeks of the fourth year.

It consists of the method of construction and design of the various kinds of foundations used in engineering construction together with a study of the bearing power of different kinds of soil.

145. Highway Engineering.

A course of one hour per week throughout the second year, in which are treated the following subjects:

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The construction of roads and city streets, the problems of drainage and maintenance, qualities of trap rocks, good gravel, binding materials, paving blocks and bricks, concrete foundations, and the uses of asphaltic oils and other bituminous materials.

150. Railroad Engineering.

Preparation: Plane and Topographic Surveying (131).

This course in railroad engineering is given three hours per week during the last twenty weeks of the third year. It consists of the computation and methods of laying out simple, compound, reverse, and easement curves; frogs, switches, and turnouts; the computation of earthwork by different methods, slope stakes, borrow pits and cross section work.

151. Railroad Drawing.

Preparation: Plane and Topographic Surveying (131).

This course is given one evening per week during the third year.

From field notes a map and profile of a preliminary survey for a railroad are plotted. The location is discussed and adjusted to the preliminary map. Other drawings involving the study of problems common to railroad practice will be taken up. The course is supplemented by lectures.

153. Railroad Engineering and Design.

Preparation: Railroad Engineering (151) and Railroad Drawing (152).

This course is given three hours per week during the fourth year. It consists of a study of yard design, passenger and freight yards, gravity yards, hump yards, yard accessories, stations, terminals, elimination of grade crossings, signals, methods of construction and making estimates.

A large part of the work is supplemented by lectures.

160. Municipal Engineering.

A course of three hours per week in the fourth year dealing with various engineering problems encountered by town and city engineers such as construction of sewers, retaining walls,

NORTHEASTERN COLLEGE

bridges, grade crossing problems, making of contracts and writing specifications for various construction work, methods of inspection and handling of public service properties, such as poles, lines, conduits, tracks, etc.

DEPARTMENT OF MECHANICAL ENGINEERING

Instructor:

H. C. MABBOTT, S.B.

This course is designed to give a broad foundation in those fundamental subjects which form the basis for all professional engineering practice.

170. Mechanism.

This course of one and one-half hours per week, throughout the second year, takes up a study of the principles in machinery and power transmission apparatus. The problem work goes into the design of pulleys, belts, gearing and gear teeth development, cams, and quick return motions found in machine tools such as shapers, slotters, and planers.

171. Mechanical Engineering Drawing.

This course of one and one-half hours per week supplements the course in mechanism. It consists in the actual design of cams and gears, with graphical solution of velocity and force problems.

175. Applied Mechanics.

This course of 70 hours in the third year comprises a study of statics, including the determination of stresses in frames; centre of gravity, moment of inertia and radius of gyration; kinematics and dynamics including uniform and varying rectilinear and curvilinear motion, centrifugal force, momentum, impact, work, power and kinetic energy.

180. Thermodynamics.

This course of one hour per week during the third year is devoted to the study of the theory of perfect gases and thermodynamics. The use of steam and entropy tables and solutions of general problems in steam; also heating and ventilation.

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181. Boilers and Prime Movers.

This course of two and one half hours per week, in the fourth year, is devoted to the study of the practical operation of boilers and boiler accessories and the principles of boiler design. The work also covers the essentials of steam engine and turbine design and strength of parts of steam engines such as pistons rods, cylinders, crossheads, flywheels, etc.

182. Power Plant Design.

A course of one and one-half hours per week, partly lectures and partly drawing room work, in power plant design and layout. The course treats of the proper layout of boilers, pipes, condensers, separators, ash and coal handling machinery, and calculation of the building itself, as well as engine beds, chimney design, and chimney foundations.

185. Hydraulic Engineering.

A course of one and one-half hours per week. The course consists of two parts. The first is devoted to the study of theoretical hydraulics dealing with hydrostatic and hydrodynamic pressure, the flow of water through channels, pipes, orifices and nozzles and over weirs. The second part deals with such practical problems as the study of stream flow and storage and the development of water power.

186. Hydraulic Motors.

A course of one and one-half hours per week, mainly recitations covering the principles of hydrostatic and hydrodynamic pressure, the flow of water through open channels, pipes, orifices and nozzles and over weirs. Half the time is given to a study of impulse wheels and reaction turbines, with reference to their proper construction, regulation and testing, and to the various sources of loss of energy in their operation.

DEPARTMENT OF LANGUAGES

200 and 201. German I and II.

These courses of one hour per week throughout the third and fourth years respectively, are planned to give the student a knowledge of German grammar as well as a working vocabulary of scientific terms.

Equipment

THE School is now housed in the new building of the Association, and has very exceptionally equipped quarters for carrying on the work of the Engineering Courses.

MECHANICAL ENGINEERING DEPARTMENT

Mechanical Laboratories.

Our steam engineering plant is completely equipped with meters, scales, indicators, and all the necessary accessory equipment for making complete boiler tests, and determining the efficiencies of the various appliances used in generating power, heat, and light for our new building. This places at the disposal of our classes a perfectly equipped, up-to-date, engineering department, and gives them the means of carrying on boiler tests, determining the efficiencies of various fuels and oils, taking indicator diagrams, determining the efficiency of modern reciprocating engines and turbines when direct connected to generators, as well as renders them familiar with all the various auxiliary appliances of such a plant, as condensers, pumps, air compressors, etc. The students also have the use of the equipment of our Automobile School, thus giving opportunity to study the most advanced ideas in gasoline engine practice.

Mechanic Arts Laboratories.

There are at present two laboratories, one for metal work and the other for woodworking and pattern work, which are available for the use of our students.

The metal working laboratory is well equipped, and affords the student an opportunity for work with various machines, as lathes, shapers, drill presses and milling machines. There are also a gas forge and brazing furnace, together with all the required equipment for bench work instruction.

The woodworking laboratory has a power band saw, lathes, circular saw, buzz planer, and all the necessary equipment for woodworking and pattern work.

ENGINEERING SCHOOL

In addition to the foregoing, a small, but completely equipped, shop for the construction and repair of apparatus, and for the use of students in connection with their thesis work, has been installed. This shop is equipped with a metal and wood-working lathe, grinder and all the necessary wood and metal working tools. There is also a very complete set of cabinet worker's tools for use in woodworking.

CIVIL ENGINEERING DEPARTMENT

Field Instruments.

For work in the field the Department possesses various surveying instruments, representing the principal makes and types of instruments in general use. The equipment includes transits, levels, compasses, a complete plane table outfit, Locke hand level, flag poles, leveling rods, stadia rod, engineers' and surveyors' chains, steel and cloth tapes and other accessories. For Higher Surveying, an Aneroid Barometer is used for barometric leveling, and the transits are equipped with neutral glasses and reflectors for astronomical observations, as well as a sextant, reading to ten seconds, and equipped with neutral glasses and telescopes. This year a Buff and Buff Plane Table Outfit and a Berger, 18-inch Wye Level, as well as several smaller instruments, have been added to the equipment.

The scope of the equipment and the field work itself are designed to train the student's judgment as to the relative merits of the various types of field instruments.

Design and Drafting Rooms.

The School possesses large, light and well equipped drawing rooms for the carrying on of the designing and drafting, which form so important a part of civil engineering work. These rooms are supplied with lockers containing the drawing supplies, and files containing blue prints and photographs of structures that represent the best practice. Many of the prints and photographs are of structures erected in and about Boston.

NORTHEASTERN COLLEGE

ELECTRICAL ENGINEERING DEPARTMENT

The Electrical Laboratory is well equipped with apparatus for teaching the principles of measurements, and the equipment is being steadily increased and developed for the doing of work of a higher degree of precision. Among the special pieces of apparatus may be mentioned the following: Cary Foster Bridge, a modified form of Hoopes Conductivity Bridge, a Laboratory Wheatstone Bridge, a Leeds Northrup Potentiometer with Volt box, standard cells and low resistance standards, an accurate Chemical Balance and other appliances for the close determination of currents, resistances and potential differences.

There are also a set of variable inductances, and a set of condensers to the amount of eighty microfarads capacity variable in steps of one-tenth microfarad each.

Among the instruments for testing purposes, for alternating current work, may be mentioned the following: Three matched voltmeters and three General Electric Type P-3 Iron clad wattmeters arranged for Y connection, one G. E. Polyphase wattmeter with double current and potential ranges, numerous other voltmeters of various ranges, potential transformers, numerous ammeters some with current transformers, three integrating meters, one General Electric and one Westinghouse polyphase, switchboard type, integrating wattmeters and a High Torque General Electric test meter. There is also a considerable and increasing assortment of auxiliary testing apparatus, such as synchronism indicators, power factor indicators, frequency indicators, etc.

For direct current testing there is a large and increasing collection of Weston instruments, both voltmeters and ammeters, of suitable ranges and grades of precision, and two Thomson integrating watt-hour meters, while the measurement of unusual currents and voltages is ensured by four Weston millivoltmeters, with an assortment of standard shunts and multiplying resistances of various orders of magnitude.

For calibrating purposes a 600 ampere-hour storage battery has been added to the equipment for current tests, while for voltage work there is a 260-volt potential battery.

ENGINEERING SCHOOL

There is also the usual assortment of testing devices, such as speed indicators, tachometers, brakes, loading resistances and the numerous minor pieces of apparatus needed in practical testing and operating of electrical machinery.

Among the machines of this Department are a pair of specially made, matched machines arranged to run as single phase, two or three phase generators, or motors, as well as synchronous converters, double current generators, or on the Direct Current side as shunt, series, or compound generators, either two or three wire, or as motors.

There are also a 15 horse power 230-volt Westinghouse motor, a new General Electric 10 horse power Interpole 230-volt motor, a 500 volt generator, two 500-volt series, and several 500-volt shunt motors, and a series parallel controller.

A 45 K. V. A., 50-cycle, single phase, 500-volt generator giving a practically pure sine wave, three General Electric Type H transformers, each of 3 K. V. A. capacity, a $7\frac{1}{2}$ K. V. A., special General Electric 60-cycle 230-volt alternator, with revolving field tapped for either 1, 2, 3 (star or mesh connection) 6 or 12 phase connection, which may be operated also as a synchronous motor.

In addition to the above are a 5 H. P. G. E. single phase induction motor, which may also be operated as a three phase motor and a 10 H. P. Fort Wayne shunt motor driving a special Holtzer-Cabot 3 phase 5 K. B. A. Alternating Current Generator. This latter machine has two special rotors, permitting its use as a squirrel cage or phase wound induction motor, there being a three phase regulating resistance for use with the phase wound rotor.

During the past year there has been added a 5 K. W. Holtzer-Cabot three phase synchronous converter. This is wound for 220 volts on the D. C. side and will permit of the use of the above mentioned specially matched generators as balancers in connection with this unit.

There is also available for advanced instruction, in co-operation with the Mechanical Department, the four three-wire generators (two driven by reciprocating engines and two by

NORTHEASTERN COLLEGE

Westinghouse-Parsons turbines) in the main generating plant of the Association.

DEPARTMENT OF PHYSICS

There is a large laboratory devoted entirely to Physics together with a lecture room.

The Physics Department has been very completely equipped with all necessary apparatus for the experimental work that is required of the students, as well as that required for lecture demonstration. Among other things have been added: verniers, levels, spherometers, calorimeters, thermometers, pyrometers, a spectroscope, a microscope, a spectrometer, balances, standard gram weight, lecture table galvanometer, optical disk with all accessories, lenses, photometer, a full set of Weather Bureau apparatus, including a barograph, thermograph, hygrometer, barometer, maximum and minimum thermometers, etc. These, in addition to the equipment already owned, give a wide range to the experimental work that can be done.

DEPARTMENT OF CHEMISTRY

This Department is completely equipped in all respects for carrying on all lines of Chemical work, from that of a High School to that of most advanced College grade. The three laboratories, with accommodations for over one hundred and fifty students, are very exceptionally furnished with all the necessary appliances for chemical work. Some of these are: hoods, drying closets, still, steam and hot water baths, electrolytic circuits, vacuum and pressure apparatus, balances, combustion furnaces, complete sets of apparatus for the sampling and analysis of flue gases and fuels. There are also testing machines for oils, viscosimeters, and different sorts of flash point apparatus. A chemical museum is connected with this Department where are kept specimens for purposes of illustration.

ENGINEERING SCHOOL

LIBRARIES

There is in connection with the School a professional library containing books pertaining to both the school work of the boys and to their practical work. In addition to this there also are current periodicals on engineering and scientific subjects for their exclusive use. All members of the School are entitled to take books from the Boston Public Library, and this offers a very unusual opportunity to our non-resident students.

DEPARTMENT OF PHYSICAL TRAINING

Our new gymnasium with all the latest modern equipment gives ample accommodation for all students.

There is a running track on the grounds adjoining, together with tennis, and hand ball courts; also a large natatorium where swimming is taught by competent instructors.

In connection with this Department there are also six excellent bowling alleys, which may be used by the students upon the payment of a nominal fee.

RESTAURANT AND BARBER-SHOP

Attention is called to the fact that there is a spa on the first floor and restaurant in the basement of the Association building. There is also a barber shop in the basement.

For all further information, write

THE EVENING SCHOOL OF ENGINEERING,
316 Huntington Ave., Boston, Mass.

Additional Information

The School reserves the right to retain for its annual exhibition, and for any other purpose which it may deem necessary, drawings made by students.

Scholarships.

As an aid to worthy men who desire an education and are unable to pay in full even our slight charges, a limited number of scholarships have been provided, which will be judiciously distributed by the Educational Committee, to whom application should be made.

Entrance Requirements.

Any man of good character, regardless of age, occupation or creed, with adequate general education may be enrolled in the School, provided he can show that he is sufficiently prepared to take up the studies of the first year. High School graduates should find no difficulty.

A student may elect any subject, or combination of subjects, which best serves his particular needs. However, to prevent loss of time and expense to the student, he will not be allowed to elect courses which, on account of inadequate preliminary training and experience, he could not pursue with profit. The Dean should be consulted before registration.

Certificates.

Upon the satisfactory completion of any of the regular, or special courses, the student is entitled to receive a certificate. No certificates will be given, however, unless the student has successfully performed the prescribed work and passed the necessary examinations.

Suburban Members.

All tickets held by members of the Cambridge, Chelsea, Everett, Lynn, Malden, Melrose, Newton, Quincy, Salem and Somerville Associations, will be honored for membership in the Boston Association.



MAIN LOBBY

Schedule of Rates

Courses I and II (Chemistry and Electrical Engineering)

First year, \$35, including membership payable as follows:—\$15 upon entering, \$10 November 15 and \$10 January 15.

Second, third and fourth years, \$50 each, including membership, payable as follows:—\$20 upon entering, \$15 November 15 and \$15 January 15.

Courses III, IV and V (Structural, Civil and Mechanical Engineering)

First year, \$30, including membership, payable as follows:—\$10 upon entering, \$10 November 15 and \$10 January 15.

Second, third and fourth years, \$50 each, including membership, payable as follows:—\$20 upon entering, \$15 November 15 and \$15 January 15.

Special Note—The following rates are in addition to membership (\$2). In case more than one course is taken, a discount of \$3 for each additional course will be made.

Course	Tuition	Course	Tuition
68 Adv. Alternating Currents	\$15.00	38 Life Class	\$20.00
11 Adv. Mech. Drawing and Orthographic Projections	13.00	12 Machine Drawing	13.00
116 Advanced Structures	24.00	135 Materials of Construction	24.00
132 Advanced Surveying	13.00	2 Mathematics I	15.00
170 Applied Mechanics	18.00	3 Mathematics II	15.00
20 Architectural Drawing I	10.00	10 Mechanical Drawing	10.00
21 Architectural Drawing II	10.00	171 Mechanical Eng. Drawing	18.00
22 Architectural Drawing III	13.00	170 Mechanism	18.00
181 Boilers and Prime Movers	24.00	160 Municipal Eng.	30.00
112 Bridge Design	24.00	*45 Organic Chemistry	50.00
117 Concrete Construction	24.00	71 Power Transmission	13.00
65 Elec. Eng., Lab. A. C.	12.00	131 Plane and Topo. Surveying	24.00
63 Elec. Eng., Lab. D. C.	20.00	100 Practical Physics	15.00
69 Elec. Eng., Lab., Advanced	15.00	60 Practical Electricity	24.00
70 Electricity Supply Stations	13.00	Power Plant Design	18.00
72 Electric Railways	13.00	*42 Qualitative Analysis	38.00
64 Elements of Elec. Eng. A. C.	12.00	151 Railroad Drawing	24.00
62 Elements of Elec. Eng. D. C.	24.00	165 Railroad Engineering	18.00
140 Foundations	13.00	153 R. R. Engineering and Design	30.00
30 Freehand Drawing I	10.00	115 Strength of Materials	24.00
31 Freehand Drawing II	10.00	111 Structural Design	24.00
185 German I		110 Structural Drawing	24.00
186 German II		113 Structural Mechanics	24.00
*44 Gravimetric Analysis	30.00	*46 Technical Analysis	25.00
145 Highway Engineering	18.00	66 and 67 Tech. Elect. Meas'ments	24.00
150 Hydraulic Engineering	18.00	47 Theoretical Chemistry I	18.00
151 Hydraulic Motors	13.00	48 Theoretical Chemistry II	18.00
35 Industrial Design	10.00	114 Theory of Structures	24.00
*49 Industrial Chemistry	18.00	180 Thermodynamics	13.00
*40 and 41 Inorganic Chemistry	24.00	130 Topographical Drawing	18.00
		*43 Volumetric Analysis	30.00

*Owing to the increased price of all material used in the chemical laboratories, due to war conditions, a laboratory fee of two dollars will be charged to each student taking courses in the chemical laboratories.

NORTHEASTERN COLLEGE

The tuition for all courses payable in advance unless stated to the contrary in which case times of payment are indicated. Numbers preceding courses refer to description of courses, pages 15 to 39.

Students who discontinue a course, but who have attended four or more recitations in the subject, will be required to pay a term's tuition.

No student is permitted to transfer from one course to another without consulting the Dean beforehand and receiving a transfer order which must be presented at the main office for the proper ticket.

POLYTECHNIC ASSOCIATION

This is an organization formed and managed by the students. Its object is to provide social gatherings for the Engineering students, and to establish a bond of friendship among the men.

All men entering the Engineering School may join this association by filling out the proper blank at the educational office. Membership is free.

A school pin, pennant and engraved stationery with Polytechnic design may be ordered by the members.

General Departments

Department of Recreation and Health

ALBERT E. GARLAND, M.D., B.P.E., Director

This Department offers the BEST RECREATION that RE-CREATES. Privileges as follows: Three Gymnasiums, Swimming Tank of Filtered Salt Water, Baths of all kinds, Classes to Music, Six Bowling Alleys, Tennis—Indoor and Out, Handball, Squash, Indoor Golf, Athletics—Indoor and Out, Basket-ball and Games, Boxing, Wrestling and Fencing. Best of Instruction. Medical Direction. *Come in any time.*

Department of Religious Work

EDWIN W. PEIRCE, Secretary

In order that young men may secure a well-balanced development and attain the true foundation for successful living, the Association advises each member to so plan his schedule that he may enter into one or more of the following activities:

Character Building Classes

Young Men's Sunday Forum

Gospel Team

Personal Interviews

Training for Christian Service

Lectures and "Talks"

Worker's Library

Twenty-four-hour-a-day Club

Department of Social Work

DAVID M. CLAGHORN, Director

The attention of members is called to the many opportunities in the Association for social service, and the following social features:

A Newly Equipped Game Room

The Association Congress

Popular Social Evenings

El Club Sarmiento (Pan-American Club)

The Land and Water Club

Concerts and Entertainments

Department of Council and Placement

FREDERICK W. ROBINSON, Director

Advice given to young men concerning their vocational future and efforts made to place them in positions best adapted to their varied abilities.

It also acts as a clearing house for young men seeking work and employers desiring to engage reliable help.

Its service is not limited to members, but the latter are given liberal discounts and effort is made to notify them when good positions are open.

Boys' Division

JAMES G. BARNES, S.B., City Boys' Work Secretary

The Boys' Division is made up of boys from Greater Boston whose needs are ministered to by a force of young men who have made a careful study of "boyology." The Division comprises boys from twelve to eighteen years of age, whose needs are studied and whose problems we try to solve. Activities are conducted along social, physical, educational, and spiritual lines. The annual membership fee is \$2.00; gymnasium and natatorium privileges are open to the boys at special rates.

NORTHEASTERN COLLEGE

January

1917

CATALOG
of the
Evening
School of Engineering



1917 - 1918

Published by

The TRUSTEES of NORTHEASTERN COLLEGE

Boston Young Men's Christian Association

Number 316 Huntington Avenue, Boston, Massachusetts

NORTHEASTERN COLLEGE

SCHOOL OF LAW

Evening Sessions Only

Established in 1898; incorporated in 1904. Provides a four years' course in preparation for the Bar, and grants the Degree of Bachelor of Laws.

SCHOOL OF COMMERCE AND FINANCE

Evening Sessions

Established in 1907; incorporated in 1911. Offers the following four-year courses leading to the degree of B. C. S. (Bachelor of Commercial Science): Banking, Business Administration, Finance and Bond Salesmanship, and Professional Accountancy. Anyone passing the examination for advanced standing is enabled to complete any one of the four regular courses and secure the degree in three years. Special courses in addition to regular courses.

CO-OPERATIVE SCHOOL OF ENGINEERING

Day Sessions

Four-year courses in Chemical, Mechanical, Electrical, and Civil Engineering, in co-operation with business firms. Students earn while learning. Open to High School graduates.

EVENING SCHOOL OF ENGINEERING

Evening Sessions

A school offering three- and four-year courses in Chemistry, Chemical, Electrical, Structural, Railroad and Mechanical Engineering.

SCHOOL OF LIBERAL ARTS

Evening Sessions

Beginning with the fall of 1916, courses of college grade in English, Mathematics, Science, History, and Education will be offered. Professors and instructors of New England colleges will be engaged. These courses are open to graduates of high schools and to others who can meet the entrance requirements.

For further information concerning any of the above schools or departments, address

NORTHEASTERN COLLEGE

316 Huntington Avenue, Boston, Massachusetts

NORTHEASTERN COLLEGE

January 1917

CATALOG *of the* Evening School of Engineering



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Boston Young Men's Christian Association
Number 316 Huntington Avenue, Boston, Massachusetts

Calendar 1917-1918

SEPTEMBER 18-21
REGISTRATION

SEPTEMBER 24
OPENING OF FIRST TERM

OCTOBER 12
COLUMBUS DAY
HOLIDAY

NOVEMBER 29
THANKSGIVING DAY
HOLIDAY

DECEMBER 19-25
CHRISTMAS RECESS

DECEMBER 31
BEGINNING OF SECOND TERM

JANUARY 1
NEW YEAR'S DAY

FEBRUARY 22
WASHINGTON'S BIRTHDAY
HOLIDAY

APRIL 13
CLOSE OF SCHOOL

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EVENING SCHOOL OF ENGINEERING

THE NEW NAME **Northeastern College**

For many years the terms Evening Law School, School of Commerce and Finance, and Co-operative School of Engineering, have been applied to the corresponding schools of the Department of Education. These names, however, were not distinctive, and both graduates and students requested that a regular title be given the schools doing work of college grade. As a result of their activities, the schools concerned were very thoroughly investigated by outside educational experts, to see if the scope and grade of work done would properly measure up to that of the recognized colleges and technical schools. Such was found to be the case in all the schools, and upon the submission of the various reports by the Educational Committee to the Board of Directors of the Association, the latter Board voted to apply the name "Northeastern College" to the group of schools comprising the following:

SCHOOL OF LAW

SCHOOL OF COMMERCE AND FINANCE

CO-OPERATIVE SCHOOL OF ENGINEERING

EVENING SCHOOL OF ENGINEERING

SCHOOL OF LIBERAL ARTS

These schools will henceforth be known as the regular schools of Northeastern College, of the Boston Young Men's Christian Association, and the College has been incorporated under Massachusetts law.

GENERAL INFORMATION

GENERAL INFORMATION

Many men in various lines of industry feel the need of special instruction in Engineering, either to advance in their normal occupation, or to enable them to change their positions and get into work of an Engineering nature.

To such men the Evening School of Engineering offers a wide variety of regular Engineering Courses, and in addition, special instruction for those who desire it, in Architecture, Drawing and Design. The Engineering Courses require attendance from two to three evenings a week, during a period of from three to five years, and, while only the fundamental subjects are taken up, the courses compare very favorably with similar courses offered by the good technical schools of the country.

Four-year Engineering Courses

Regular four-year courses, leading to a diploma, are offered in the following branches of Engineering:

- I Civil Engineering
- II Mechanical Engineering
- III Structural Engineering
- IV Electrical Engineering
- *V Chemistry

*There is a fifth elective year in the Chemistry Course for those desiring special instruction of an industrial and engineering nature.

These courses will be found outlined on succeeding pages (see Index) and the subjects of which they are comprised will be found described in detail under the heading "Subjects for Instruction" (see Index).

Special Non-Engineering Courses

Special courses in Architecture, Freehand and Mechanical Drawing and Industrial Design, are offered by the School, and will be found described in detail in the latter part of this catalog. (See Index.)

EVENING SCHOOL OF ENGINEERING

Requirements for Admission

The work carried on in the Engineering Courses assumes that the entering student has had previous training in Elementary Algebra, Plane Geometry and has a good ground-work in English. Practically, an entering student should have completed at least from one to two years' work in a good high school. Those who have completed a full high school course should be excellently fitted to carry on the courses and should derive the maximum benefit from the work.

Those men who finished grammar school, but who have not had the requisite previous training in Mathematics and English, can attend the Evening Courses of the Northeastern Preparatory School, and should be able to get the necessary preparation for entrance to the Engineering School in one year.

There are no entrance examinations for entering students, but each applicant for admission is required to have an interview with the Dean.

The Dean will ascertain the qualifications of each applicant, and advise him as to just what work he is qualified to undertake. The student then enrolls in the proper classes and his advancement is entirely dependent on the ability that he displays in the accomplishment of the prescribed work in his various subjects.

Should a student prove to be unable to handle any of his studies successfully, he may be required to discontinue that subject, and complete such preparatory work as is deemed necessary, before being re-admitted to the subject in question.

Tuition Fees

For all regular courses the tuition fees are as follows:

The first year tuition in the full Engineering Course is thirty-five (35) dollars.

This amount, which includes membership in the Association, is payable as follows:

- \$15.00 upon entering the School
- 10.00 November 15th
- 10.00 January 15th

GENERAL INFORMATION

The tuition fee for all years, except the first, is fifty dollars, which includes membership in the Association. This amount is payable as follows:

\$20.00 upon entering the School
15.00 November 15th
15.00 January 15th

Students who discontinue a course, but who have attended four or more recitations in the subject, will be required to pay a term's tuition.

The tuition fees for the Special Courses will be found toward the back of the catalog. (See Index.)

Laboratory Fees

All students taking courses in the Chemical Laboratories are charged a laboratory fee of four dollars. This fee is payable in advance, and does not cover breakage, or destruction of apparatus.

A laboratory deposit of four dollars must be made before a desk will be assigned to a student. At the close of the school year the cost of equipment broken, or used up, by the student, will be deducted from this amount and the balance refunded. Students failing to check up their desks upon leaving school shall be charged one dollar extra.

Transfers

No student is permitted to transfer from one course to another without consulting the Dean beforehand and receiving a transfer order, which must be presented at the main office for the proper ticket.

Reports of Standing

Informal reports of the students' standing are issued twice during the school year, and formal reports, covering the year's work, are issued at the close of each year.

EVENING SCHOOL OF ENGINEERING

Physical Training

By a special arrangement between the Department of Recreation and Health and the School, it has been made possible for those students who desire it to get the privileges of the gymnasium and natatorium, for special hours, upon the payment of seven dollars and a half, in addition to the tuition. By this means our students may avail themselves of these privileges at a minimum cost.

Positions Held by Graduates

The graduates of the School are in constant demand, and it may safely be said that those who complete one of the courses successfully can be sure of desirable employment in his chosen line.

Naturally the School cannot, and does not, guarantee to place its graduates in positions, but our experience has been that we have not been able to find men for all the positions we have been asked to fill.

Special Students

Any of the subjects taught in the School may be taken singly, provided the head of the department concerned is satisfied that the student can pursue the work to advantage.

Those desiring to take such special work should consult the Dean, who will advise as to the steps to be taken.

Scholarships

As an aid to worthy men who desire an education and are unable to pay in full even our slight charges, a limited number of scholarships has been provided, which will be judiciously distributed by the Board of Governors, to whom application should be made.

Diplomas and Certificates

Upon the satisfactory completion of any of the regular courses, the student is entitled to receive a diploma. The

GENERAL INFORMATION

satisfactory completion of one or more subjects entitles the student to receive a certificate stating the credits he has received. No certificates will be given, however, unless the student has successfully performed the prescribed work and passed the necessary examinations.

Suburban Members

All tickets held by members of the Cambridge, Chelsea, Everett, Lynn, Malden, Melrose, Newton, Quincy, Salem, and Somerville Associations will be honored for membership in the Boston Association.

EVENING SCHOOL OF ENGINEERING

CIVIL ENGINEERING

The purpose of this course is to give the student an education in those subjects which form the basis of all branches of technical education, and a special training in those subjects comprised under the term "Civil Engineering." It is designed to give the student sound training, both theoretical and practical, in the sciences upon which professional practice is based.

Civil Engineering covers such a broad field that no one can become expert in its whole extent. It includes Topographical Engineering, Municipal Engineering, and Railroad Engineering. It covers land surveying, the building of railroads, harbors, docks and similar structures; the construction of sewers, waterworks, roads and streets. All of these branches of Engineering rest, however, upon a relatively compact body of principles, and in these principles the students are trained by practice in the class room, drawing room and the field.

The course is designed to prepare the young engineer to take up the work of assisting in the location and construction of steam and electric railways, sewerage and water supply systems.

COURSE I

CIVIL ENGINEERING

First Year

	SUBJECT NUMBER
Mathematics I	10
Practical Physics	20
Mechanical Drawing	40

Second Year

Mathematics II	11
Surveying and Plotting	50
Topographical Drawing	54
Highway Engineering	56

Third Year

*Structural Mechanics	32
**Advanced Surveying	51
Railroad Engineering	57
Railroad Engineering Drawing	58

Fourth Year

*Railroad Engineering and Railroad Design	59
**Municipal Engineering	55
*Foundations	82
**Materials of Construction	81
Hydraulic Engineering	112

*First term.

**Second term.

EVENING SCHOOL OF ENGINEERING

MECHANICAL ENGINEERING

This course is designed to give a foundation in those fundamental subjects which form the basis for all professional engineering practice, and to especially equip the young engineer with a knowledge of the various phases of Mechanical Engineering. The course embraces instruction by text-book, lecture, and drawing room.

The course affords training in the methods, and gives practice in the process of Construction, which develops in the student the capacity for thinking along mechanical lines, thus enabling him to base all of his work upon fundamental principles already learned, rather than upon empirical rules. It is the endeavor to give the student a good theoretical training and meanwhile devote sufficient time to the practical work, so that he may become a proficient engineer, both in theory and in practice in the various branches of Mechanical Engineering.

COURSE II

MECHANICAL ENGINEERING

First Year

	SUBJECT NUMBER
Mathematics I	10
Practical Physics	20
Mechanical Drawing	40

Second Year

Mathematics II	11
Mechanism	90
Mechanical Engineering Drawing	91
Machine Drawing	92

Third Year

Applied Mechanics I	30
Thermodynamics	95
Hydraulic Engineering	112
*Foundations	82
**Materials of Construction	81

*First term.

**Second term.

Fourth Year

(Omitted in 1917-1918)

Boilers and Prime Movers	95A
Power Plant Design	96
Concrete Construction	80

EVENING SCHOOL OF ENGINEERING

STRUCTURAL ENGINEERING

The purpose of this course is to give the student a special training in those subjects comprised under the term "Structural Engineering." It is designed to give the student sound and thorough training in the science upon which professional practice is based.

Structural Engineering covers such a broad field that no one can become expert in its whole extent. It includes the design and construction of girders, columns, roofs, trusses, arches, bridges, buildings, walks, dams, foundations and all fixed structures and movable bridges. It includes also a knowledge of the relative merits of the design and construction of buildings, bridges and structures composed of the different materials used by the engineer, such as concrete, reinforced concrete, timber, cast iron and steel. Structural Engineering also includes cost accounting, plan reading and estimating.

The course is designed to prepare the young engineer to take up the work of assisting in the design and construction of structures; to undertake intelligently supervision of erection work in the field and general contracting.

COURSE III
STRUCTURAL ENGINEERING

First Year

	SUBJECT NUMBER
Mathematics I	10
Practical Physics	20
Mechanical Drawing	40

Second Year

Mathematics II	11
Structural Mechanics	32
Structural Drawing	73

Third Year

Theory of Structures	70
Strength of Materials	33
Structural Design	74

Fourth Year

Advanced Structures	72
Bridge Design	71
Concrete Construction	80

EVENING SCHOOL OF ENGINEERING

ELECTRICAL ENGINEERING

The course in electrical engineering is intended primarily to cover the needs of two classes of men: (1) men who are working in the electrical or mechanical trades involving the use of electricity, who desire to increase their knowledge of practical electricity and to gain a thorough understanding of the electrical engineering principles and their broader application, so as to prepare themselves for positions of foremen, superintendents, or operating managers, in their particular field; (2) young men in business, possessing a good general education, who wish to gain a knowledge of the technical matters of electricity, together with a sufficiently broad conception of the theories underlying all electrical engineering work, in order to render themselves more useful in their line of business, by the combined general and technical training.

The ideal condition for laying out a single course to serve the variety of needs, represented by the individual interests of the students, would obviously be exact equality of preparation for all students beginning the work of the first year. Though such equality cannot be expected of all the men entering the first year, there must be a certain general basis of preparation, in order that the work may be of the greatest benefit to the largest number of men; therefore, the work of the first year has been laid out in such a way as to be of no special difficulty to those with a high school training, or the equivalent thereof; at the same time, certain men who have not had such preparation, but whose experience in practical life has sufficiently matured them, should be able to enter the first year with success, though they may be required to make up some of the preparatory work, while they may be excused from certain portions of the practical work with which their experience may have brought them into contact. It is recommended that such men should consult with the Dean or the course head in arranging their schedule. In general, a man entering the first year should (1) have easy command of the English language, so that he may be able to express himself and write clearly, (2) be familiar with elementary mathematics and algebra.

COURSE IV

ELECTRICAL ENGINEERING

First Year

	SUBJECT NUMBER
Mathematics I	10
Practical Physics	20
Mechanical Drawing	40

Second Year

Mathematics II	11
*Mechanism	90
*Elements of Electricity, Lectures	126
*Elements of Electricity, Laboratory	127
**Direct Current Machinery, Lectures	122
**Direct Current Machinery, Laboratory	124

Third Year

*Direct Current Machinery, Lectures	122
**Direct Current Machinery, Laboratory	124
Applied Mechanics I A	31
Thermodynamics	95
Alternating Currents and Electrical Measurements, Lectures	138
Alternating Currents and Electrical Measurements, Laboratory	138A

Fourth Year

Alternating Current Machinery, Lectures	139
Alternating Current Machinery, Laboratory	139A
Generation and Utilization of Power	136

*First term.

**Second term.

CHEMICAL ENGINEERING

The wonderful advance in the application of science to the arts during the past few years has caused a great demand for technically trained men. Nearly every large manufacturing concern now employs chemists regularly, or else has experts whom it can consult at short notice. The scientific and technical schools are each year sending out large classes of young men, especially trained to meet this demand. For a young man to acquire this education requires four years at a scientific, or technical school, in addition to the four years necessary for preparation at the secondary school, and an outlay of from two to three thousand dollars. These necessary expenditures of time and money are such that many young men, who are mentally capable of taking such courses, are obliged to give up their ambitions and fill inferior positions.

Formerly the practical knowledge which young men acquired by contact with their work was sufficient, but today the degree of specialization is such that a theoretical knowledge is essential to success in many industries where chemical processes are utilized.

There are many men who, by close application to the practical side, have acquired responsible positions in technical industries, but are unfamiliar with the theoretical side of their chosen work.

Such men are unable to advance in their special lines, because they cannot read the many valuable books written on special technical subjects, which presuppose a general knowledge of the theory of chemistry.

At the present time, the requirements of admission to the higher institutions of learning, even for special students, are such that the doors are practically closed to these men, although many of them could take special courses with profit. Again, the only available hours for such men are during the evening. There is a demand, therefore, for a systematic evening course in chemistry, which will be open to men engaged at the present time in technical industries.

Students are especially urged to take the entire work on the schedule of each year. A good grounding in mathematics, physics and German is essential to success in the chemical subjects of the third and fourth years.

COURSE V

CHEMICAL ENGINEERING

First Year

	SUBJECT NUMBER
Mathematics I	10
Inorganic Chemistry, Lectures	140
Inorganic Chemistry, Laboratory	141

Second Year

Qualitative Analysis, Lectures	142
Qualitative Analysis, Laboratory	143
Elements of Physics	21

Third Year

(Omitted 1917-1918)

Volumetric Analysis	144A
Gravimetric Analysis	144B
German I	170

Fourth Year

Organic Chemistry, Lectures	145
Organic Chemistry, Laboratory	145A
Principles of Chemistry I	149
German II	171

Fifth Year

(Only offered when sufficient students enroll for it to justify giving the work.)

Technical Analysis	148
Principles of Chemistry II	149A
Industrial Chemistry	146
Thermodynamics	95

Subjects for Instruction

Instruction is given by lectures and recitations, and by practical exercises in the field, the laboratories, and the drawing rooms. A great value is set upon the educational effect of these exercises, and they form the foundation of each of the four courses. Text-books are used in many subjects, but not in all. In many branches the instruction given differs widely from available text-books; and, in most of such cases, notes on the lectures and laboratory work are issued, and are furnished to the students. Besides oral examinations in connection with the ordinary exercises, written examinations are held from time to time. At the close of the year general examinations are held.

In the following pages will be found a more or less detailed statement of the scope, as well as the method of instruction, of the subjects offered in the various courses. The subjects are classified, as far as possible, related studies being arranged in sequence.

The subjects are numbered, or numbered and lettered, for convenience of reference in consulting the various Course Schedules. As the total number of hours per term devoted to a subject sometimes varies in different courses, these hours are not in every case given in connection with the following descriptions.

By careful consideration of the Course Schedules, in connection with the following Description of Subjects, the applicant for a special course may select, for the earlier part of that course, such subjects as will enable him to pursue later those more advanced subjects which he may particularly desire.

The topics, included in the list which follows, are subject to change at any time by action of the School authorities.

SYNOPSIS OF SUBJECTS

SYNOPSIS OF SUBJECTS

10. Mathematics I

Preparation: Elementary Algebra and Plane Geometry.

This course includes:

Review of Algebra up to and including simple equations. Radicals, imaginaries, quadratic equations, ratio and proportion, variation, the use of formulæ, with applications to problems in Physics and Engineering.

Review of Geometry, with special reference to problems in mensuration.

Logarithms, the use of slide rules, discussion of precision, and rules for significant figures.

Trigonometry, including circular measure, co-ordinates, trigonometric ratios, formulæ, law of sines, law of cosines, solution of right and oblique triangles, applications to problems in Physics and Engineering.

11. Mathematics II

Preparation: Mathematics I.

This course of two periods per week during the second year is a continuation of Mathematics I. It includes:

Plotting of functions, interpolation, the straight line, equations of the conic sections, curves represented by various equations common in practice, graphic solution of equations, determination of laws from the data of experiments, simplification of formulæ.

Rate of change, differentiation, determination of maxima and minima by differentiation, integration, definite integrals, determination of mean value, area, and volume by integration, centre of gravity, moment of inertia.

20. Practical Physics

This course consists of two lectures per week, on Monday and Thursday evenings, throughout the year. Instruction is given in the practical application of physical laws. Each lecture, as far as possible, is accompanied by practical tests in the lecture room on large size apparatus, built especially for this course, so that the student may actually see a demonstra-

EVENING SCHOOL OF ENGINEERING

tion of the truth of the various laws, thus enabling him to grasp readily the underlying principles. The course is devoted to a study of the mechanics of solids, liquids and gases, heat and its effects, together with lectures on light and sound. Practical problems covering each phase of the work are given throughout the year which are designed to fix in the student's mind the fundamental principles taken up in the lectures. The supplies for this course are a set of notes on "Practical Physics" prepared by C. S. Ell, a pair of small four- or five-inch triangles and a four-inch cardboard protractor.

21. Elements of Physics

A course of experimental lectures and exercises, designed especially for students of Chemistry. The work is devoted to a study of the mechanics of solids, liquids, and gases; heat and its effects; and elementary electricity. The problems are also planned to give drill work in Mathematics in its applications to Physics.

30. Applied Mechanics I

The subject comprises a study of the general methods and applications of statics, including the determination of reactions, stresses in frames, of distributed forces, center of gravity, of moment of inertia and radius of gyration of plane areas and solids. Kinematics and dynamics are also taken up.

31. Applied Mechanics 1A

This course, which is a briefer one than Course 30, covers only the fundamental principles and their applications, in place of the full treatment of the subject that is carried out in Course 30.

32. Structural Mechanics

This course covers the fundamental principles of statics, including the study of systems of balanced and unbalanced forces; determination of reactions and stresses in framed structures; a study of the centre of gravity and moment of inertia of plane figures, shear and moment diagrams, and the application of the various principles of mechanics to the solution of simple structural problems. The work consists of

SYNOPSIS OF SUBJECTS

lectures, recitations, and the solution of problems, many of which are done in the class room.

33. Strength of Materials

This course consists of lectures, recitations and the solution of problems. Instruction is given in the strength of materials, mathematically treated, including the stresses and strains in bodies subjected to tension, to compression and to shearing; common theory of beams, with thorough discussion of the distribution of stresses, shearing forces, bending moments, slopes, and deflections.

A study is also made of the strength of hooks, columns, shafts, and springs, and combined stresses in beams subjected to tension and compression, as well as bending. A brief consideration of strains, and the relations of the stresses on different planes in a body and the stresses in simple framed structures subjected to bending forces, is also taken up.

The latter part of the course is devoted to a study of the methods of manufacturing, properties, and strength of various materials used by the engineer. All the structural materials commonly used are considered, such as lime, cement, concrete, timber, brick, iron, steel and stone. A study is also made of the results of tests on these materials.

40. Mechanical Drawing

This course consists of work of an elementary character, beginning with instruction in the use of instruments and the fundamental rules for executing engineering drawings. In conjunction with the drawing, the elementary principles of orthographic projections are studied, and the student prepares a number of plates illustrating the reproduction of objects in the shape of working drawings.

50. Surveying and Plotting.

Preparation: Trigonometry or Math. II (II).

The first term is devoted to a study of surveying instruments, the methods of making surveys and the solution of problems in plane surveying.

In the second term, the methods used in topographic surveying, together with the problems relating thereto, are taken

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up in detail, as well as advanced and special problems in plane surveying.

Special emphasis is laid on the construction and use of the various kinds of maps and plans with which the surveyor should be familiar.

51. Advanced Surveying.

Preparation: Surveying and Plotting (50).

This course consists of instruction in the higher problems in surveying, such as triangulation, precise, trigonometric and barometric leveling. Map projection, and the plane table are discussed.

54. Topographical Drawing

Preparation: Mechanical Drawing (40).

This course is primarily designed to give training in the interpretation and drawing of topographical maps. It is devoted to the study of the different conventional signs employed, and each student is required to make a number of plates and to become reasonably proficient in the preparation of such maps. Particular attention is given to the study of contour maps, and the solution of problems relating thereto.

55. Municipal Engineering Problems

A course dealing with various engineering problems encountered by town and city engineers, such as construction of sewers, retaining walls, bridges, grade crossing problems, making of contracts and writing specifications for various construction work, methods of inspection and handling of public service properties, such as poles, lines, conduits, tracks, etc.

56. Highway Engineering

A course in which are treated the following subjects:

The construction of roads and city streets, the problems of drainage and maintenance, qualities of trap rocks, good gravel, binding materials, paving blocks and bricks, concrete foundations, and the uses of asphaltic oils and other bituminous materials.

SYNOPSIS OF SUBJECTS

57. Railroad Engineering

Preparation: Surveying and Plotting (50).

This course in railroad engineering consists of the computation and methods of laying out simple, compound, reverse, and easement curves; frogs, switches, and turnouts; the computation of earthwork by different methods, slope stakes, borrow pits and cross section work.

58. Railroad Engineering Drawing

Preparation: Surveying and Plotting (50).

From field notes, a map and profile of a preliminary survey for a railroad are plotted. The location is discussed and adjusted to the preliminary map. Other drawings involving the study of problems common to railroad practice will be taken up. The course is supplemented by lectures.

59. Railroad Engineering and Railroad Design

Preparation: Railroad Engineering (57) and Railroad Engineering Drawing (58).

This course consists of a study of yard design, passenger and freight yards, gravity yards, hump yards, yard accessories, stations, terminals, elimination of grade crossings, signals, methods of construction and making estimates.

A large part of the work is supplemented by lectures.

70. Theory of Structures

This course consists of lectures, recitations and solution of problems. Instruction is given in the fundamental theory of structures, including the theory of beams, computation of reactions, moments, and shears for static and moving loads. The work in the class-room is supplemented by the solution of many practical problems in the drawing room.

71. Bridge Design

Most of the work of this course is done in the drawing room, but instruction is given from time to time by means

EVENING SCHOOL OF ENGINEERING

of lectures. The work includes the execution of complete designs for several types of structures, such as railroad bridges and building trusses, and the execution of complete working drawings.

72. Advanced Structures

This course is a continuation of the theory of structures given in the third year, and takes up the fundamental principles involved in the design of various engineering structures, such as buildings, bridges, retaining walls, arches and other structures, as the time permits. Instruction is given by means of lectures and recitations, and the various theoretical principles are applied in the execution of practical designs in the drawing room.

73. Structural Drawing

The course in structural drawing consists in the working out of various graphical problems of mechanics on the drawing board, drawing standard sections of structural steel shapes, structural details and the preparation of drawings, representing simple structures. The purpose of this course is to familiarize the student with detailed drawings and teach him where and how to dimension structural parts on working drawings.

74. Structural Design

The course in structural design consists of work in the drawing room. It is a continuation of the course in structural drawing given in the second year, and includes the execution of elementary structural design, taking up in a practical way the principles given in the course in Theory of Structures. Each student is given data for various problems, the designs for which he works out in the drawing-room, making all necessary computations and executing all drawings necessary for the preparation of a complete design of a number of engineering structures.

80. Concrete Construction

In this course instruction is given in the history and early use of cement; different kinds of cement manufacture; sand, gravel, broken stones, and methods of mixing; description

SYNOPSIS OF SUBJECTS

of concrete work; roadways, sidewalks, building work, footings, foundations, conveying concrete, placing, finishing and waterproofing; principles of reinforced concrete, formulas for calculating strength, tables of strength, values; reinforcing steel, expanded metals, wire fabrics; design and construction. Simple formulas and application, use of tables, beams, and girders, bearing power of soil, forms and molds, removal of forms, problems in beam, slab and girder designs, and arches. Cost estimating and requirements of the building laws.

81. Materials of Construction

A course taking up a consideration of the properties of the various materials used in engineering construction, such as wood, iron, steel, brick, stone, cement and concrete.

82. Foundations

A course covering the method of construction and design of the various kinds of foundations used in engineering construction, together with a study of the bearing power of different kinds of soil.

90. Mechanism

This course takes up a study of the principles in machinery and power transmission apparatus. The problem work goes into the design of pulleys, belts, gearing and gear teeth development, cams, and quick return motions found in machine tools such as shapers, slotters, and planers.

91. Mechanical Engineering Drawing

This course of one and one-half hours per week supplements the course in mechanism. It consists in the actual design of cams and gears, with graphical solution of velocity and force problems.

92. Machine Drawing

The aim of the course is to teach the proper way of making the necessary dimensioned drawings for use in practice. The instruction includes: (a) The making of sketches of the parts of a machine from measurements; (b) the detail scale drawing from the sketches and a tracing; (c) an assembly drawing of the machine.

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95. Thermodynamics

This course of one hour per week during the third year is devoted to the study of the theory of perfect gases and thermodynamics. The use of steam and entropy tables and solutions of general problems in steam; also heating and ventilation.

95A. Boilers and Prime Movers

This course of two and one half hours per week, in the fourth year, is devoted to the study of the practical operation of boilers and boiler accessories and the principles of boiler design. The work also covers the essentials of steam engine and turbine design and strength of parts of steam engines such as piston rods, cylinders, crossheads, flywheels, etc.

96. Power Plant Design

A course of one and one half hours per week, partly lectures and partly drawing room work, in power plant design and layout. The course treats of the proper layout of boilers, pipes, condensers, separators, ash and coal handling machinery, and calculation of the building itself, as well as engine beds, chimney design, and chimney foundations.

112. Hydraulic Engineering

A course of one and one half hours per week. The course consists of two parts. The first is devoted to the study of theoretical hydraulics dealing with hydrostatic and hydrodynamic pressure, the flow of water through channels, pipes, orifices and nozzles and over weirs. The second part deals with such practical problems as the study of stream flow and storage and the development of water power.

122. Direct Current Machinery

A course of lectures and recitations consisting of three hours per week during the last fourteen weeks of the second year, and two and one half hours per week during the first fourteen weeks of the third year. The course is devoted to the study of the principles and operation of direct current machinery. The following topics are considered: direct current generators and motors, their construction, operation, and

SYNOPSIS OF SUBJECTS

application; direct current systems, involving the use of generators, motors, storage batteries, etc., in combination; electric lighting and photometry.

124. Direct Current Machinery, Laboratory

This course of one evening per week during the last fourteen weeks of the second year and the first fourteen weeks of the third year, is taken simultaneously with the corresponding lecture course (122), and the experiments are intended to supplement the class-room work of that course. The experiments cover the operation of a dynamo as a motor and generator, the photometer, etc. The characteristics of direct current generators and motors are determined experimentally; efficiency, losses, regulation and heating are carefully studied in the laboratory. Each student is required to furnish a complete report, including theory, method of procedure, results, and conclusions on each experiment performed by him.

126. Elements of Electricity

A course of lectures and recitations, one and one half hours per week, during the first fourteen weeks of the school year. The course deals with the fundamental laws and properties of electric and magnetic circuits and their application to the similar types of electrical apparatus. Among the subjects studied are units of resistance, current, potential, and power, Ohm's Law and Kirchoff's Law.

127. Elements of Electricity, Laboratory

This course of one evening per week, during the first fourteen weeks of the second year, is taken in connection with the corresponding lecture course (126). The experiments are intended to supplement the classroom work.

136. Generation Transmission and Utilization of Power

A course of lectures, recitations, and problem work, two hours per week, for twenty-eight weeks. This course is intended to cover the field of electrical engineering in a broader and more general way than do the other courses previously described. It deals with the various types of generating stations, some of the features of long distance power transmission, the application of electric power to railways, etc.

EVENING SCHOOL OF ENGINEERING

138. Alternating Currents and Electrical Measurements

A course of lectures, recitations and problem work during the last fourteen weeks of the third year. The principles of electromagnetism, electrostatics, variable currents and harmonic alternating currents, including single and polyphase circuits, are carefully studied. This course also includes a brief discussion of the theory, construction and operation, of the more common types of measuring instruments and testing processes.

138A. Alternating Currents and Electrical Measurements, Laboratory

A course of one evening per week during the last fourteen weeks of the third year. The course is devoted to the experimental study of alternating current circuits, power measurements in single and polyphase circuits, and selected experiments in direct and alternating current measurements.

139. Alternating Current Machinery

A course of lectures, recitations, and problem work, consisting of three hours per week for twenty-eight weeks. The course is devoted to a detailed study of the common types of alternating current machines, including the transformer, alternator, induction motor, synchronous motor, rotary converter, etc.

139A. Alternating Current Machinery, Laboratory

This course of one evening per week, for twenty-eight weeks, consists of laboratory exercises devoted to experimental study of the transformer, alternator, and other types of alternating current apparatus, supplementing the corresponding class-room work of Course 139.

140. Inorganic Chemistry

A course of experimental lectures on the fundamental laws and principles of inorganic chemistry. The work aims to familiarize the student with the properties and preparation of the following elements and their most important compounds:—oxygen, hydrogen, the halogens, sulfur, nitrogen, phos-

SYNOPSIS OF SUBJECTS

phorus, carbon, silicon, the alkali and alkaline earth groups, iron and aluminum. The course is to be taken in conjunction with (141).

141. Inorganic Chemistry Laboratory

A laboratory course in which the student is expected to verify and illustrate the facts and principles that have been discussed in the lectures. To be taken in conjunction with (140).

142. Qualitative Analysis

A practical course in qualitative analysis relating to the identification of the common metallic elements and the ordinary acids.

143. Qualitative Analysis, Laboratory

Preparation: 142.

A practical course in qualitative analysis for the separation and identification of the common metallic elements and the acids. Each student is also required to make a complete and accurate analysis of various mixtures, alloys and chemicals used in manufacturing.

144A. Volumetric Analysis

A course on volumetric determinations, involving the use and the standardization of burettes, pipettes and measuring flasks. The work includes alkalimetry, acidimetry, indicators, oxidimetry, iodimetry, chlorimetry. The laboratory work is supplemented by lectures and conferences.

144B. Gravimetric Analysis

A course devoted to the principles and practice of gravimetric analysis. The laboratory work is supplemented by lectures and conferences.

145. Organic Chemistry

The course is devoted to lectures and conferences on the principles of organic chemistry, as illustrated by the methane and benzene derivations.

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145A. Organic Chemistry, Laboratory

In this course the student is required to prepare in the laboratory a number of organic compounds, selected to show the characteristic reactions, and to give training in the practical separation and purification of organic substances. After this synthetic work, the students are given a practical course in organic analysis.

146. Industrial Chemistry

A course of lectures and conferences on the more important chemical processes. Attention is given to many operations of a general nature common to chemical industries, such as crushing, grinding, filtration, evaporation, distillation, etc., and to the apparatus employed in these processes. Some of the more important industries will be taken up in detail.

148. Technical Analysis

A course on the following:

Analysis of gases.

Analysis and testing of mineral, animal and vegetable oils.

The origin, manufacture, properties, uses and analysis of the various fuels, and the determination of the heat value of fuels by the use of a calorimetric bomb.

149 and 149A. Principles of Chemistry I and II

A course of lectures and conferences on chemical equilibrium and electro-chemical topics. The work includes lecture experiments and discussion of problems on the law of mass action, applied to the rate and equilibrium of chemical reactions, the effect of temperature and pressure, the conduction of electricity by solutions, the production of electricity by chemical change, the electromotive force of voltaic cells and single potential differences. Problems for independent solution by the student are also given.

170 and 171. German I and II

These courses of one hour per week throughout the third and fourth years respectively, are planned to give the student a knowledge of German grammar as well as a working vocabulary of scientific terms.

SPECIAL COURSES

Special Courses

DEPARTMENT OF DRAWING

Instructors:

MR. JAMES BROUGH

MR. E. W. G. SMITH

MR. GEORGE A. TRUELSON

The courses in Free Hand Mechanical and Architectural Drawing and Industrial Design, as outlined, afford the essentials of drafting for those contemplating office work and are equally valuable and necessary to those working in the allied trades.

The art courses are varied and the work is thorough, complete, and of a high order. Great care is taken to develop the student along the line of his natural inclinations, and, so far as possible, to have the work of the school bear directly upon his daily employment and other courses attended.

301. Advanced Mechanical Drawing and Orthographic Projections

This course is a continuation of Mechanical Drawing (40). It includes:

Problems on the point, line and plane, projections of solids, single and double curved surfaces and their intersections by oblique planes, and practical illustrations of the principles studied.

310. Architectural Drawing I

An elementary course, including the fundamental principles underlying all kinds of mechanical and architectural drawing; geometrical problems; orthographic and isometric projections; classical mouldings; Roman alphabet, and roof problems.

In connection with this course the instructor will outline a course of reading in architectural history.

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311. Architectural Drawing II

The orders of Architecture. Practical architecture and details of construction. In this course the student is taught the component parts of buildings. Typical details of construction are drawn to a large scale and in isometric projection.

312. Architectural Drawing III

This course covers the making of complete plans, elevations and working drawings of some elementary problem.

Special Students

Students desiring special work in Architectural Drawing, not outlined above, should consult with the instructor.

320 and 321. Freehand Drawing

Considering the great importance of the study of freehand drawing to all who are engaged in, or anticipate being engaged in any industrial art, artistic trade or profession, we offer a very complete course in this line, and call attention to the splendid advantages provided.

The work is adapted to the requirements of each individual student, so far as is practical and consistent with a thorough training in freehand drawing. There are two classes in both freehand drawing and industrial design.

Class I. The work of this class is intended to meet the wants of those students who have no previous knowledge of freehand drawing and is recommended to all students who intend to become craftsmen, designers, architects or artists, and also to others who may wish to take up the study as an accomplishment. The work will consist of drawing from typical models, by which students learn a sense of proportion and the principles of perspective; groups of still life for the study of composition and color; also drawing of historic ornament, and details of the human figure from the cast, by which students are taught to observe form, and the principles of light and shade.

SPECIAL COURSES

Class II. The course of study in this class is of a more advanced nature than that of Class I, and in addition to the more complicated forms of ornament, the full-length human figure from the antique is added, also rendering in pen and ink and pencil, advanced shading in charcoal, painting groups of still life in monochrome and polychrome, in oil and water colors.

322. Industrial Design and Interior Decoration

The courses in industrial design and interior decoration are specially helpful to those students who are already engaged in or anticipate being engaged in such arts and crafts, as wood and stone carving, wrought and bent-iron work, brass and copper work, stained glass, furniture and drapery, interior decoration, book covers, wall paper, fabrics and other allied industrial arts, including lettering and commercial designing for advertising purposes. No limitation is placed upon the student who shows ability to take up the work prescribed for the class he wishes to enter, and students who so desire may spend part of their time in the freehand class and part in the industrial design and interior decoration class, without extra charge. The instructor is a certified art master and one of the leaders of the profession. Students in industrial design are recommended to take architecture.

323. Life Class

At the repeated request of a number of advanced students we offer this class which will give an exceptional opportunity to students who wish to pursue their studies for the purpose of acquiring a more perfect knowledge of the figure, and will be of great advantage to those who wish to become more proficient in this branch of art. At the present time the use of the figure is introduced into nearly every form of art work, not only in a purely artistic sense, but also in many forms of commercial work, and to be able to draw the figure well is a great achievement to the artist and designer. This work will only be given when a sufficient number of students enroll for it.

Equipment

The school is now housed in the new building of the Association, and has very exceptionally equipped quarters for carrying on the work of the Engineering Courses.

MECHANICAL ENGINEERING DEPARTMENT

Our steam engineering plant is completely equipped with meters, scales, indicators, and all the necessary accessory equipment for making complete boiler tests, and determining the efficiencies of the various appliances used in generating power, heat, and light for our new building. This places at the disposal of our classes a perfectly equipped, up-to-date, engineering department, and gives them the means of carrying on boiler tests, determining the efficiencies of various fuels and oils, taking indicator diagrams, determining the efficiency of modern reciprocating engines and turbines when direct connected to generators, as well as renders them familiar with all the various auxiliary appliances of such a plant, as condensers, pumps, air compressors, etc. The students also have the use of the equipment of our Automobile School, thus giving opportunity to study the most advanced ideas in gasoline engine practice.

Mechanic Arts Laboratories

There are at present two laboratories, one for metal work and the other for woodworking and pattern work, which are available for the use of our students.

The metal working laboratory is well equipped, and affords the student an opportunity for work with various machines, as lathes, shapers, drill presses and milling machines. There are also a gas forge and brazing furnace, together with all the required equipment for bench work instruction.

The woodworking laboratory has a power band saw, lathes, circular saw, buzz planer, and all the necessary equipment for woodworking and pattern work.

In addition to the foregoing, a small but completely equipped shop for the construction and repair of apparatus and for the

EQUIPMENT OF THE SCHOOL

use of students in connection with their thesis work has been installed. This shop is equipped with a metal and woodworking lathe, grinder, and all the necessary wood and metal-working tools. There is also a very complete set of cabinet-worker's tools for use in woodworking.

CIVIL ENGINEERING DEPARTMENT

Field Instruments

For work in the field the Department possesses various surveying instruments, representing the principal makes and types of instruments in general use. The equipment includes transits, levels, compasses, a complete plane table outfit, Locke hand level, flag poles, leveling rods, stadia rod, engineers' and surveyors' chains, steel and cloth tapes and other accessories. For higher surveying, an aneroid barometer is used for barometric leveling, and the transits are equipped with neutral glasses and reflectors for astronomical observations, as well as a sextant, reading to ten seconds, and equipped with neutral glasses and telescopes. Last year a Buff and Buff Plane Table Outfit and a Berger 18-inch Wye Level, as well as several smaller instruments, were added to the equipment.

The scope of the equipment and the field work itself are designed to train the student's judgment as to the relative merits of the various types of field instruments.

Design and Drafting Rooms

The School possesses large, light, and well-equipped drawing rooms for the carrying on of the designing and drafting, which form so important a part of civil engineering work. These rooms are supplied with lockers containing the drawing supplies, and files containing blue prints and photographs of structures that represent the best practice. Many of the prints and photographs are of structures erected in and about Boston.

ELECTRICAL ENGINEERING DEPARTMENT

The Electrical Measurements Laboratory is well equipped with apparatus for teaching the principles of measurements, and the equipment is being steadily increased and developed for the performance of a wider range of work. The special

EVENING SCHOOL OF ENGINEERING

pieces of apparatus are as follows: A modified form of Conductivity Bridge, a Laboratory Wheatstone Bridge, a Leeds and Northrup Potentiometer with volt box, standard cells and low resistance standards, and a chemical balance. A 600 ampere-hour storage battery has been added to the equipment for current tests, while for voltage work there is a high-voltage direct-current generator, having separate field excitation and speed control, for wide range of voltage adjustment.

Among the instruments used for alternating current testing are the following: Three General Electric wattmeters, constructed for Y connection; a General Electric polyphase indicating wattmeter, with double current and potential ranges; a General Electric indicating wattmeter, with double current and potential ranges, constructed for the measurement of transformer core loss, three Thomson high-torque induction watt-hour meters, with special gear trains for short-time readings; a General Electric and a Westinghouse, switchboard type, integrating watt-hour meter, and a Thomson rotating standard test meter. There is also a large number of indicating ammeters and voltmeters, and auxiliary testing apparatus, such as synchronism and frequency indicators.

For direct current testing there is a considerable number of Weston and General Electric ammeters and voltmeters of suitable ranges, and two Thomson integrating watt-hour meters.

There is also an increasing assortment of testing devices, such as speed counters, tachometers, brakes, loading resistances, and numerous minor pieces of apparatus needed in the practical operation and testing of electrical machinery.

Among the machines of this department are a pair of specially made matched machines, constructed to operate as single, two, or three phase generators, or motors, as well as synchronous converters, or double current generators. On the direct-current side, these machines will operate as shunt, series, or compound generators, either two or three wire, or as shunt, series, or compound motors. There is also a 15 H. P. Westinghouse compound motor, a 3 K. W. compound genera-

EQUIPMENT OF THE SCHOOL

tor, two one-half H. P. series motors, a one-half H. P. shunt motor, and a 1 K. W. series generator. During the past year there has been added a 5 H. P. General Electric interpole motor, a 5 H. P. General Electric series motor, a 4 H. P. shunt motor, two 3 H. P. shunt motors, and a 2 H. P. shunt motor.

There is also a 7½ kv-a. special General Electric alternator driven by a 10 H. P. General Electric interpole motor, and a 5 kv-a. Holtzer-Cabot alternator driven by a 10 H. P. Fort Wayne shunt motor. This latter machine has two special rotors, permitting its use as a squirrel-cage or phase-wound, induction motor. In addition, there is a 5 K. W. Holtzer-Cabot three-phase synchronous convertor, a 5 H. P. General Electric induction motor, which can be operated two or three phase, a 45 kv-a. single phase alternator, giving practically a pure sine wave, and three General Electric transformers, each of 3 kv-a. capacity. During the past year there has been added three special 1 K. W. single-phase transformers, each of 3 kv-a. capacity.

There is also available for advanced instruction, in co-operation with the Mechanical Engineering Department, the four three-wire generators in the main generating plant. Two of these generators are driven by Ridgeway reciprocating engines and two by Westinghouse-Parsons turbines.

DEPARTMENT OF PHYSICS

There is a large laboratory devoted entirely to Physics, together with a lecture room.

The Physics Department has been very completely equipped with all necessary apparatus for the experimental work that is required of the students, as well as that required for lecture demonstration. Among other things have been added. verniers, levels, spherometers, calorimeters, thermometers, pyrometers, a spectroscope, a microscope, a spectrometer, balances, standard gram weight, lecture table galvanometer, optical disk with all accessories, lenses, photometer, a full set of Weather Bureau apparatus, including a barograph, thermograph, hygrometer, barometer, maximum and minimum thermometers,

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etc. These, in addition to the equipment already owned, give a wide range to the experimental work that can be done.

DEPARTMENT OF CHEMISTRY

This Department is completely equipped in all respects for carrying on all lines of Chemical work, from that of a high school to that of most advanced college grade. The three laboratories, with accommodations for over one hundred and fifty students, are very exceptionally furnished with all the necessary appliances for chemical work. Some of these are: hoods, drying closets, still, steam and hot water baths, electrolytic circuits, vacuum and pressure apparatus, balances, combustion furnaces, complete sets of apparatus for the sampling and analysis of flue gases and fuels. There are also testing machines for oils, viscosimeters, and different sorts of flash point apparatus. A chemical museum is connected with this Department where are kept specimens for purposes of illustration.

LIBRARIES

There is in connection with the School, a professional library containing books pertaining to both the school work of the students and to their practical work. In addition to this there also are current periodicals on engineering and scientific subjects for their exclusive use. All members of the School are entitled to take books from the Boston Public Library, and this offers a very unusual opportunity to our non-resident students.

DEPARTMENT OF PHYSICAL TRAINING

Our new gymnasium with all the latest modern equipment gives ample accommodation for all students.

There is a running track on the grounds adjoining, together with tennis and hand ball courts; also a large natatorium where swimming is taught by competent instructors.

In connection with this Department there are also six excellent bowling alleys, which may be used by the students upon the payment of a nominal fee.

For all further information, write

THE EVENING SCHOOL OF ENGINEERING,
316 Huntington Ave., Boston, Mass.

COURSES OF STUDY

Courses of Study

SCHEDULE OF ENGINEERING SUBJECTS

Subject Number	Subject	Evenings	Time
10	Mathematics I	Mon. and Thurs.	7.00—8.15
11	Mathematics II	Mon. and Thurs.	8.15—9.30
20	Practical Physics	Mon. and Thurs.	8.15—9.30
21	Elements of Physics	Mon. and Thurs.	8.15—9.00
30	Applied Mechanics I	Mon. and Thurs.	8.15—9.30
31	Applied Mechanics I A	Friday	8.15—9.30
32	Structural Mechanics	Mon. and Thurs.	7.00—8.15
33	Strength of Materials	Mon. and Thurs.	7.00—8.15
40	Mechanical Drawing	Wednesday	7.00—9.30
50	Surveying and Plotting	Mon. and Thurs.	7.00—8.15
51	Advanced Surveying	Mon. and Thurs.	7.00—8.15
54	Topographical Drawing	Tuesday	7.00—8.15
55	Municipal Engineering Problems	Wed.	7.00—9.30
56	Highway Engineering	Tues.	8.15—9.30
57	Railroad Engineering	Mon. and Thurs.	8.15—9.30
58	Railroad Engineering Drawing	Fri.	7.00—9.30
59	Railroad Engineering and Railroad Design	Wed.	7.00—9.30
70	Theory of Structures	Mon. and Thurs.	8.15—9.30
71	Bridge Design	Fri.	7.00—9.30
72	Advanced Structures	Mon. and Thurs.	8.15—9.30
73	Structural Drawing	Tues.	7.00—9.30
74	Structural Design	Fri.	7.00—9.30
80	Concrete Construction	Mon. and Thurs.	7.00—8.15
81	Materials of Construction	Mon. and Thurs.	7.00—8.15
82	Foundations	Mon. and Thurs.	7.00—8.15
90	Mechanism	Mon.	7.00—8.15
91	Mechanical Engineering Drawing	Thurs.	7.00—8.15
92	Machine Drawing	Wed.	7.00—9.30
95	Thermodynamics	Tues.	8.15—9.30
95A	Boilers and Prime Movers	Mon. and Thurs.	8.15—9.30
96	Power Plant Design	Tues.	7.00—9.30
112	Hydraulic Engineering	Tues.	7.00—8.15
122	Direct Current Machinery, Lectures	Mon. and Thurs.	7.00—8.15
124	Direct Current Machinery, Laboratory	Wed.	7.00—9.30
126	Elements of Electricity, Lectures	Thurs.	7.00—8.15
127	Elements of Electricity, Laboratory	Wed.	7.00—9.30
136	Generation, Transmission and Utilization of Power	Tues. and Fri.	7.00—8.15
138	Alternating Currents and Electrical Measurements, Lectures	Tues. and Fri.	7.00—8.15

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138A	Alternating Currents and Electrical Measurements, Laboratory	Wed.	7.00—9.30
139	Alternating Current Machinery, Lectures	Tues. and Fri.	8.15—9.30
139A	Alternating Current Machinery, Laboratory	Mon.	7.00—9.30
140	Inorganic Chemistry, Lectures	Mon. and Thurs.	8.15—9.30
141	Inorganic Chemistry, Laboratory	Wed.	7.00—9.30
142	Qualitative Analysis, Lectures	Mon.	7.00—8.15
143	Qualitative Analysis, Laboratory	Tues.	7.00—9.30
*144A	Volumetric Analysis	Tues. and Wed.	7.00—9.30
**144B	Gravimetric Analysis	Tues. and Wed.	7.00—9.30
145	Organic Chemistry, Lectures	Wed.	7.00—8.15
145A	Organic Chemistry, Laboratory	Mon. and Tues.	7.00—9.30
146	Industrial Chemistry	Wed.	7.00—9.30
148	Technical Analysis	Tues.	7.00—9.30
149	Principles of Chemistry I	Wed.	8.15—9.30
149A	Principles of Chemistry II	Mon.	7.00—8.15
170	German I	Mon.	7.00—8.15
171	German II	Mon.	8.15—9.00

* First term.

** Second Term.

Special Subjects

301	Advanced Mechanical Drawing and Orthographic Projections	Wed.	7.00—9.30
310	Architectural Drawing I	Mon. and Fri.	7.00—9.30
311	Architectural Drawing II	Mon. and Fri.	7.00—9.30
312	Architectural Drawing III	Mon. and Fri.	7.00—9.30
320	Freehand Drawing I	Tues. and Thurs.	7.00—9.30
321	Freehand Drawing II	Tues. and Thurs.	7.00—9.30
322	Industrial Design	Tues. and Thurs.	7.00—9.30
323	Life Class	Tues. and Thurs.	7.00—9.30

RATES OF TUITION

REGULAR COURSES

The tuition for the first year of all regular courses is thirty-five (35) dollars, payable as follows:

\$15.00 upon entering
\$10.00 November 15
\$10.00 January 15

The tuition for all years, but the first, of the regular courses shall be fifty (50) dollars, payable as follows:

\$20.00 upon entering
\$15.00 November 15
\$15.00 January 15

Beginning in September, 1919, all full Courses, now costing fifty dollars, will be advanced to fifty-five dollars for the year's tuition, this increased rate will not apply to students enrolled previous to September, 1917. The foregoing rates include membership in the Association.

Individual Engineering Subjects

Course	Tuition	Course	Tuition
72 Advanced Structures	25.00	81 Materials of Construction	10.00
51 Advanced Surveying	15.00	10 Mathematics I	15.00
138 Alt. Cur. and Elec. Meas.		11 Mathematics II	15.00
Lectures	10.00	40 Mechanical Drawing	10.00
138A Alt. Cur. and Elec. Meas.		91 Mech. Eng. Drawing	20.00
Laboratory	10.00	90 Mechanism	20.00
139 Alt. Cur. Mach., Lec.	20.00	55 Municipal Eng. Probs.	20.00
139A Alt. Cur. Mach., Lab.	20.00	145 *Organic Chem., Lec.	24.00
30 Applied Mechanics I	15.00	145A *Organic Chem., Lab.	24.00
31 Applied Mechanics I A	10.00	96 Power Plant Design	18.00
95A Boilers and Prime Movers	25.00	20 Practical Physics	15.00
71 Bridge Design	25.00	149 Principles of Chem. I	20.00
80 Concrete Construction	25.00	149A Principles of Chem. II	20.00
122 Direct Cur. Mach., Lec.	15.00	142 *Qualitative Analysis, Lec.	22.00
124 Direct Cur. Mach., Lab.	15.00	142 *Qualitative Analysis, Lab.	22.00
126 Elements of Elec., Lec.	8.00	57 Railroad Engineering	15.00
127 Elements of Elec., Lab.	8.00	58 Railroad Eng. Drawing	20.00
21 Elements of Physics	15.00	59 Railroad Engineering and	
82 Foundations	10.00	Railroad Design	20.00
136 Generation, Transmission		33 Strength of Materials	25.00
and Utilization of Power	25.00	74 Structural Design	25.00
170 German I	10.00	73 Structural Drawing	20.00
171 German II	10.00	32 Structural Mechanics	25.00
144B *Gravimetric Analysis	25.00	50 Surveying and Plotting	25.00
56 Highway Engineering	10.00	143 *Technical Analysis	20.00
112 Hydraulic Engineering	15.00	70 Theory of Structures	25.00
146 *Industrial Chem.	20.00	95 Thermodynamics	15.00
140 *Inorganic Chem., Lec.	13.00	54 Topographical Drawing	10.00
141 *Inorganic Chem., Lab.	13.00	144A Volumetric Analysis	25.00
92 Machine Drawing	14.00		

*Owing to the increased price of all materials used in the chemical laboratories, due to war conditions, a laboratory fee of four dollars will be charged to each student taking courses in the chemical laboratories. In addition, a laboratory deposit of four dollars will be required. This deposit is returnable upon payment of all breakage and other charges.

Special Courses

301 Advanced Mech. Draw. &		320 Freehand Drawing I	10.00
Orthographic Projections	\$10.00	321 Freehand Drawing II	10.00
310 Architectural Drawing I	10.00	322 Industrial Design	10.00
311 Architectural Drawing II	10.00	323 Life Class	20.00
312 Architectural Drawing III	10.00		

Special Note.—The above rates are in addition to membership (\$2). In case more than one subject is taken, a discount of \$3 for each additional subject will be made.

General Departments

Boston Young Men's Christian Association

Department of Recreation and Health

ALBERT E. GARLAND, M.D., B.P.E., Director

This Department offers the *best recreation that re-creates*. Privileges as follows: Three Gymnasiums, Swimming Tank of Filtered Salt Water, Baths of all kinds, Classes to Music, Six Bowling Alleys, Tennis—Indoor and Out, Handball, Squash, Indoor Golf, Athletics—Indoor and Out, Basket-ball and Games, Boxing, Wrestling and Fencing. Best of Instruction. Medical Direction. Come in any time.

Department of Religious Work

A. B. NICHOLLS, Secretary

In order that young men may secure a well-balanced development and attain the true foundation for successful living, the Association advises each member to so plan his schedule that he may enter into one or more of the following activities:

Character Building Classes	Training for Christian Service
Young Men's Sunday Forum	Lectures and "Talks"
Gospel Team	Workers' Library
Personal Interviews	Twenty-four-hour-a-day Club

Department of Social Work

DAVID M. CLAGHORN, Director

The attention of members is called to the many opportunities in the Association for social service, and the following social features:

A Newly Equipped Game Room	El Club Sarmiento (Pan-American Club)
The Association Congress	The Camera Club
Popular Social Evenings	Concerts and Entertainments

Department of Council and Placement

FREDERICK W. ROBINSON, Director

Advice given to young men concerning their vocational future and efforts made to place them in positions best adapted to their varied abilities. It also acts as a clearing house for young men seeking work and employers desiring to engage reliable help. Its service is not limited to members, but the latter are given liberal discounts and effort is made to notify them when good positions are open.

Boys' Division

JAMES G. BARNES, S.B., City Boys' Work Secretary

The Boys' Division comprises boys from twelve to eighteen years of age, whose needs are studied and whose problems we try to solve. Activities are conducted along social, physical, educational, and spiritual lines. The annual membership fee is \$2.00; gymnasium and natatorium privileges are open to the boys at special rates.

**THE EVENING
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FOUNDED FOR THE INSTRUCTION
OF MEN IN THE THEORY AND
PRACTICE OF ENGINEERING

